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ROSE TECHNIC

SEPTEMBER, 1948

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THE ROSE TECHNIC

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IN THIS ISSUE

FEATURES

FRONT COVER—In a search for oil-bearing structures the gravity survey party is taking a gravity meter reading in Cocodrie Swamp, Louisiana. Before taking the reading it was necessary to secure the skiff and build a crude platform on the side of a large cypress tree. The plates for the four-color picture were obtained through the courtesy of THE LINK, published by The Carter Oil Company.

FRONTISPIECE

Dwarfing the worker who is adjusting the bearing, the mammoth synchronous generator is equal in size to the largest machine of its type ever built by the General Electric Company. It was built in two sections so that it could be transported by rail. Its rating is 5000 kw, 164 rpm, 6600 volts, 3 phase, 60 cycles. The stator frame has a 20-foot diameter and a 43-ton rotor with a diameter of 176 inches.

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Rose Polytechnic Institute offers accredited courses leading to the degree of B.S. in chemical, civil, electrical and mechanical engineering. The next class will be admitted in January, 1949. For information address the Registrar.

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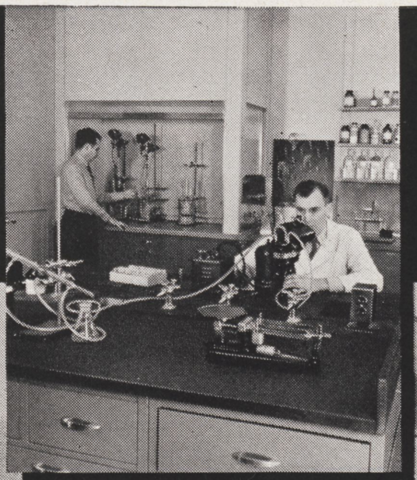
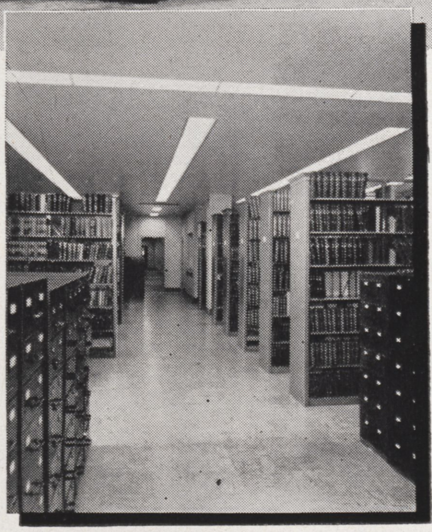


A new doorway to Petroleum Progress



No illustrations can do more than suggest the wealth of facilities at Standard Oil's new research laboratory at Whiting, Indiana. Here, in one of the largest projects of its kind in the world, there are provided the many types of equipment needed and desired for up-to-the minute petroleum research.

The caliber of the men who work here is high. For many years, Standard Oil has looked for and has found researchers and engineers of high professional competence. Further, the company has created for these men an intellectual climate which stimulates them to do their finest work.

And there is nothing new about the idea that motivates Standard Oil research. It is simply that our responsibility to the public and to ourselves makes it imperative to keep moving steadily forward. Standard Oil has always been a leader in the field of industrial research; the new Whiting laboratory is proof of our intention to remain in the front rank.

Standard Oil Company

(INDIANA)

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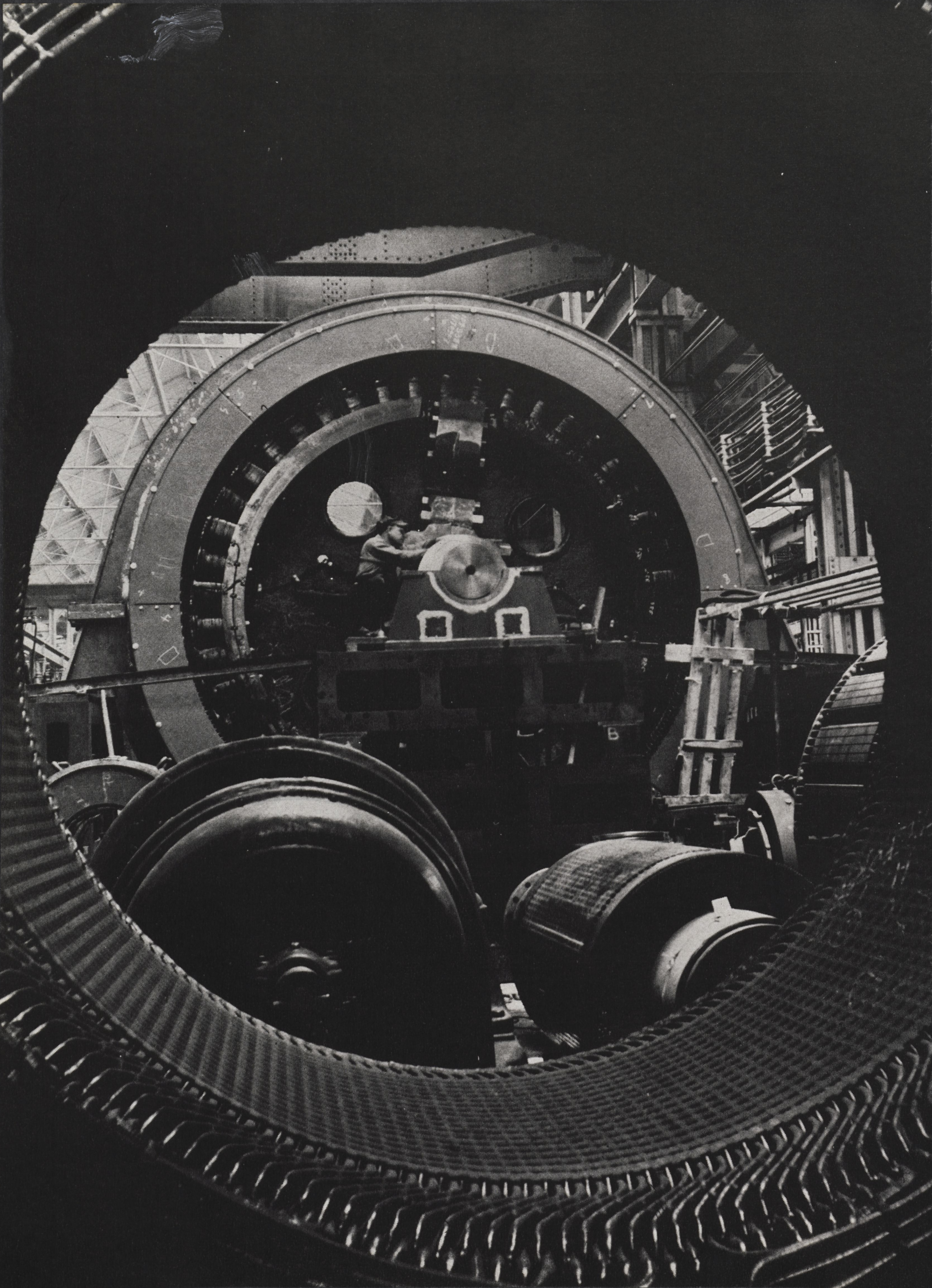

Editorial

Students at Rose are putting forth more than a usual amount of effort, compared with pre-war years, in gaining their educations, but the extra effort is not well balanced. The increased enthusiasm for acquiring technical knowledge has been matched by a corresponding decrease of interest in extra-curricular activities. The unbalance which exists between studies and extra-curricular organizations is unfortunate for several reasons.

The lack of interest in school activities is indicative of a general disinterest in community affairs, and it comes at a time when engineers especially are being exhorted to take a more active part in the community. Countless articles have appeared in engineering literature recently with the central theme that technical progress has reached the stage wherein society is now in danger of being literally blown to bits by the "Frankenstein" of its technical achievements. Therefore, they say, it is the duty of scientists and engineers to take a more active part in government, politics, and social organizations in general. The idea is that the engineer, by virtue of his training and analytical mind, has a definite contribution to make, a contribution which so far has not been given very freely.

The student who reads such articles is often inclined to identify himself with the ideas presented only in the dim future. He is simply a college student, not an engineer, and he is not likely to be eligible for active participation in government, politics, and community organization for several years.

Actually, the best time to get started in taking an active part in community activities is during college years. Far too many students, especially veterans, regard college as a mill which grinds out educations. They go to the mill every day, put in the required time, and in due course the product, a diploma, results. It is not difficult to understand why too many mediocre politicians have too much control over our destinies, if the interest students show in the college community is any indication of the interest they will show later in their local communities and national government.

Aside from the idea of responsibility to the community, there is much to be gained by the individual who takes part in extra-curricular activities. Participation presents opportunities for rounding out a heavily technical education by acquiring experience in understanding human nature through working with groups and perhaps being a leader of an organization. Dr. R. C. Mann of the Carnegie Foundation, in reporting on a survey of more than 1500 successful professional engineers, assigned weights to important traits as follows: character, 41%; judgment, 17.5%; efficiency, 14%; *understanding human nature*, 14%; and technical knowledge, 13%. Technical knowledge looks more unimportant than it actually is, since an accredited engineering degree was a prerequisite for all those considered. The rating of 13% presumably stands for technical knowledge superior to the general average. The point is that above-average technical knowledge was rated slightly lower than an understanding of human nature. A certain highly successful engineer on the Rose faculty would probably rate an understanding of human nature much higher than superior technical knowledge. He has often stressed the importance of that quality and indicated that without an understanding of people and an ability to deal successfully with diverse personalities the technical knowledge is practically useless.

Another professor has said that we go to school to make mistakes and learn from them. At school the price for mistakes is simply a lower mark on a test paper; in industry the price is much higher. That idea applies not only to technical training, but also to human relations. Where is there a better opportunity for experience in leadership and cooperation with people than in extra-curricular activities in college?

O. S.

Oil Is Where You Find It

By Paul Hill, sr., m.e.

How is oil being found today? What are the methods used by the modern petroleum companies in locating oil? Along with the growth of the oil industry a new science, geophysical prospecting, has developed to aid in the increasingly important search for oil. In this article two of the principal methods of geophysical exploration, the gravity meter and reflection seismographing, are discussed.

Oil is usually found in what are known as structural traps. A structural trap consists essentially of a floor of porous and permeable "sand" of sandstone or sedimentary rock and an overlying impervious stratum, generally shale or limestone, through which oil cannot penetrate. Oil, being comparatively light, accumulates at the top of the "sand" and is trapped there.

Since oil has no distinguishing characteristics besides possibly electrical resistivity, it cannot be found directly. It is the practice, therefore, in geophysical prospecting to look for the structure with which oil is associated, that is, to look for the different types of structural traps.

Major geophysical prospecting methods are divided into two classes: (1) Those methods without depth control, which are also known as spontaneous action methods. The two main branches of this classification are the gravity meter and the magnetic methods. These methods are generally used for reconnaissance in preparation for, (2) those methods having depth control, which give more detailed information of underground structure. In these methods reactions to energizing fields are measured. Its two branches are the seismic and the electrical methods. The reflection-seismographing method is the most important seismic method in use today.

Cut Courtesy The Lamp,
Published by Standard Oil, (N. J.)

Cablemen lay wire along a surveyed line from the recording apparatus. Ground pick-up phones are attached to the wire every 200 feet.

The Gravity Meter

The gravity meter method is based upon the fact that the force of gravity on a mass at a point on the earth's surface is affected by the density of the materials in the earth's crust below the point. Thus, when very accurate gravity readings are taken at several stations over an area of the earth's surface, small differences or gravity anomalies are obtained.

Most gravity meters utilize a small compact mass attached to a beam which is supported at the fulcrum, usually on a knife edge. The beam is held horizontally by means of a spring. Any change in the earth's gravitational field causes a change in the position of the mass which can be observed by a telescope and mirror arrangement, or an automatic photographic record can be made.

The gravity meter measures relative gravity in milligals. One milligal equals 0.001 cm./sec./sec. or about one millionth of the earth's normal gravity. Modern gravity meters are capable of attaining an accuracy of 0.1 milligal. To maintain this accuracy, electronic control of temperature within the instrument is required.

Several corrections to gravity meter readings must be made. Gravity values must be corrected for terrain, elevation and latitude. If continuous readings over a period of time are taken from a stationary gravity meter a "drift curve" can be obtained. "Drift" and "drift curves" are caused principally by temperature change and the effects of the positions of the sun and moon.

The gravity meter party normally consists of a chief, an operator, two surveyors and two rodmen. Automotive equipment is generally used for transportation. The crew, starting at a base station, takes readings every quarter or half mile along established roads or trails. Following a loop path the crew returns to the base station. A second reading is then taken at the base station for the determination of drift. Drift curves show that to obtain the most accurate results in a loop of about thirty stations the second reading at the base station should not be made much later than three to four hours after the first reading. A straight-line drift curve is then assumed for the loop and drift corrections determined for each reading.

In the interpretation of gravity meter data, gravity maps showing areas of high and low gravity are constructed. The interpretation of all gravity maps depends upon a knowledge of the characteristics of maximum gravity anomalies, which itself depends on the quantity of geological information available of the region under test. Salt domes and anticlines are both structural highs, but the salt dome, due to its low specific gravity, gives a gravity minimum, while the anticline gives a gravity maximum. A gravity high may indicate a change to a heavier formation in the same level or the rise of a given formation and vice versa. For qualitative interpretation, effects of geologic bodies of assumed densities, dimensions, and depths are calculated and varied until reasonable agreement with the field findings is obtained. Calculations are facilitated by diagrams consisting of sections of mass elements so calculated in respect to dimensions and distances that their effect at the station is identical. The greatest difficulties encountered in this method are in the interpretation of measurements.

Cut Courtesy The Lamp, *Published by Standard Oil, (N. J.)*

The seismic record is examined just to make sure that everything was working. If not, another shot will be tried immediately.

Reflection Seismographing

In the reflection seismographing method underground structure is actually mapped. Seismographing methods are based upon the properties of bodily or seismic waves in a solid. Seismic waves are of two types: (1) A compressional wave like a sound wave, such that, as the wave passes, a particle vibrates in the direction of travel of the wave; (2) A distortional wave, where the vibrating particles move at right angles to the direction of the wave. Compressional waves have the greater velocity and are the waves which are measured in seismographing. The velocity of seismic waves in a given medium depends upon the elastic properties and the density of that medium. The travel of seismic waves in the earth is controlled by the same laws as is the propagation of light.

When a dynamite charge is detonated below the earths surface, seismic waves are transmitted through the earth's interior. Part of these, known as refracted waves, travel directly to the surface of the earth. Other waves travel downward through the earth's interior. As these waves reach the surfaces of the different structural beds part of their vibrational energy is reflected back to the earth's surface. These returning waves are known as reflected waves. In reflection seismographing the time interval between the shot instant and the arrival of the reflection waves is recorded, and, together with the average velocity of the waves, is used in calculating the depths of the reflecting beds.

At the top of the earth's crust there is usually a weathered layer with a thickness generally ranging from 50 to 100 feet. Since a weathered layer has very poor sound transmission characteristics, shot holes are dug to place the charge below this layer. Shot holes are usually drilled with rotary drilling rigs mounted on trucks. Charges used may vary from a single cap to ten pounds of dynamite. Sixty percent gelatin dynamite and Nitramon are most frequently used. For maximum utilization of the charge, shot holes are tamped with water or mud.

Recording of the seismic waves which arrive at the earth's surface is done electrically. From six to twelve geophones spaced about fifty feet apart are placed in a line from the shot hole at a distance ranging from 1500 to 2000 feet. These geophones are placed in the earth and serve to convert the seismic impulses into electrical voltage just as a radio microphone converts the human voice to travel the airways. Geophones utilize a spring-suspended mass whose motion relative to the instrument frame is converted into electrical impulses by some sort of transducer.

The electrical impulses from the geophones are then amplified and, with the aid of a galvanometer and camera arrangement, recorded on photographic paper. For the segregation of impulses the vibrational characteristics of both the geophones and the galvanometers must be near-critically damped. To aid in the time separation of impulses, the photographic paper is run through the camera at a speed of from 12 to 15 inches per second. Constant paper speed increases the accuracy of record evaluation; hence, the recorder drive is equipped with a fairly elaborate governor. Time lines are projected on the photographic paper at intervals of a hundredth of a second by arrangements generally utilizing a tuning fork. It is then possible to read the time instants with an accuracy of ± 0.001 second.

The seismic record includes the following information: (1) The time break, which is the instant of charge detonation. The dynamite is set off by a special electric blasting cap, and the break in the firing circuit is transmitted electrically to the receiver. (2) The uphole time registered from a special geophone located beside the

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Cut Courtesy The Lamp, *Published by Standard Oil, (N. J.)*

A hydraulic drill bores holes as deep as 80 feet to receive the explosive. Water for the drill is pumped from a slush pit, easily blown with a bit of dynamite in any swamp.

Automatic Transmissions

By Paul Gottfried, jr., e.e.

Author's Note: The author gratefully acknowledges aid and information obtained from Buick Motor Division, Cadillac Motor Car Division, and Oldsmobile Division of General Motors Corporation; Chrysler Sales Division, Chrysler Corporation; Hudson Motor Car Company; and Packard Motor Car Company.

Almost all passenger cars now being built incorporate some form of automatic or semiautomatic mechanism designed to simplify operation of the vehicle. Frequently these devices take the form of automatic or semiautomatic transmissions, over-drives, automatic clutches, and the like, and it is the object of this article to give an overall picture of the various methods employed by engineers to obtain the desired effects. As a result, the amount of space devoted to any one drive in this article is a function of its novelty and departure from the conventional.

The nature of the subject leads to a division of this article into three sections, as follows:

1. An explanation of the principal components of automatic transmissions in general.
2. A description of the operation of representative drive units.
3. An account of the operation of vehicles equipped with these drive units from the operator's point of view.

Planetary Gearing

Since many automatic transmissions utilize planetary gear systems, and the operation of such systems is not generally understood, it appears desirable to give a brief explanation at this point.

A simple form of planetary gearing was employed in the Ford Model T automobile. It may be recalled that the Model T contained no gearshift, but that change of gear ratios was obtained by operation of pedals.

The simplest planetary gearset consists of a central or sun gear, three pinion or planet gears, an internal ring gear, and a planet carrier or spider. It may be seen that rotation imparted to the planet carrier would cause the planet gears to travel around the sun gear if the latter were held stationary, and the ring gear would be forced to travel along with the planets. If the ring gear were held stationary, as by means of a band applied to its periphery, the sun gear would be forced to turn. Locking all gears together would force the entire gearset to turn as a unit.

In the Model T, control was attained through foot-operated bands; in modern transmissions, bands are applied by means of automatic hydraulic systems.

Overrunning Clutches

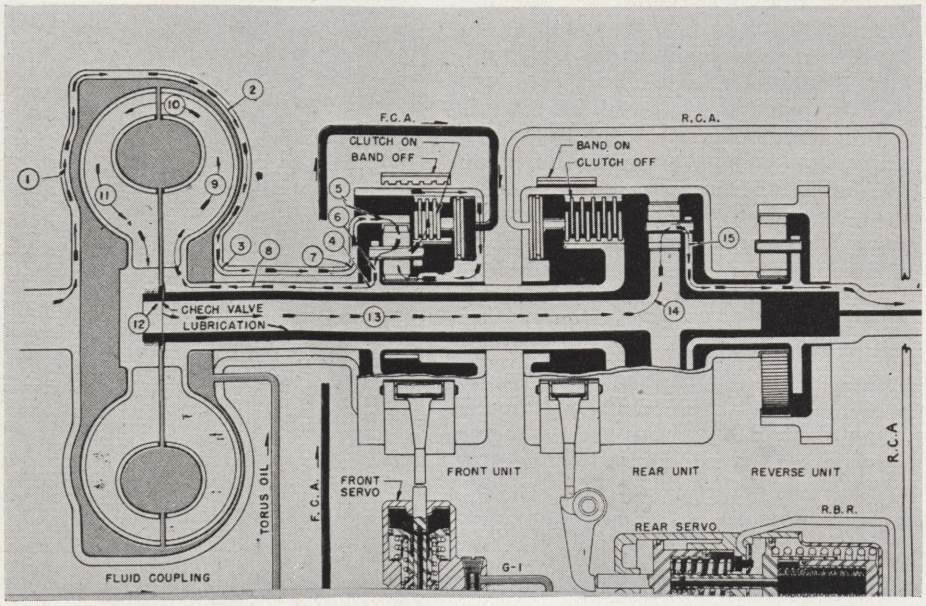
Another mechanism essential to most automatic drives is the overrunning clutch or freewheeling clutch. This unit provides a means of making linkage dependent upon load conditions and is used commonly where temporary interruption of the drive line or disconnection of units under specific conditions is desired.

The freewheel unit consists principally of an outer housing connected to the engine and an inner core coupled to the drive shaft, or some analogous connection. When the engine is driving the unit, the rollers tend to wedge themselves into place in the narrow end of the space between the core and the housing and lock the two parts together. When the load is removed from the engine, however, the rollers tend to move toward the wide portion of the space and the unit is disengaged. The response of the unit to changes in load conditions is almost instantaneous.

Fluid Couplings

The fluid coupling has the same functions as the friction clutch in the conventional drive, but is capable of much smoother action and, since idling is possible without disengagement through slippage action, clutch operation may be reduced to a minimum without the use of complex automatic clutch and/or shift mechanisms.

While several forms of fluid couplings are in use at present, the basic principles of operation are common to all. In its simplest form the coupling consists of a driving member rigidly connected to the crankshaft and a driven member attached to the transmission input shaft. Both members have the appearance and function of modified fans or impellers, connected by a liquid which serves to transmit rotation from the driving member to the driven. Slippage occurs at all speeds, but is at a minimum at ordinary driving speeds; continued operation at extremely low speeds may cause overheating of the fluid. Slip-



Cut Courtesy Oldsmobile

Oldsmobile "Hydra-Matic" Drive.

page reduces drive efficiency, fuel requirements for a fluid coupling varying from 102% to 130% (depending on speed) of the requirements of the fixed mechanical drive. Nevertheless, fluid couplings appear desirable because of increased passenger comfort, wear reduction, and because of their usefulness in conjunction with the various automatic transmissions.

Buick Dynaflow

The first continuously variable transmission to be made available in an American motor car is the Dynaflow, introduced by Buick Motor Division of General Motors Corporation early in 1948. This transmission consists of an hydraulic torque converter (see cut) in combination with a system of planetary gears, the latter not being used in ordinary forward driving. The torque converter adjusts itself in accordance with the requirements of the vehicle at any given moment, and this adjustment is not dependent upon any manual or mechanical shifting system.

The torque converter is composed of five parts—a primary pump bolted directly to the flywheel; a secondary pump mounted on a common shaft with the primary pump by means of an overrunning clutch; the driven member or turbine, which is splined to the input shaft of the planetary gear train; and finally the two "stators" that differentiate the torque converter from the ordinary fluid coupling. These stator units are mounted individually on an overrunning clutch mechanism, which maintains them in a fixed position when the unit is under full load, but permits free rotation as torque requirements are reduced. When fixed, the stators act as reaction members and provide torque multiplication corresponding to a gear ratio of up to 2.4:1; when the stators are freewheeling about their axis they have no discernible effect upon the fluid flow through the unit and the converter acts as a pure fluid coupling.

While the torque converter unit in itself fulfills all requirements of normal driving in forward speeds, it is necessary to introduce some other means to obtain reverse drive. In the Dynaflow this is accomplished through the use of a dual-pinion planetary gearset controlled by a manually selected hydraulic system. The same unit also provides an "emergency low" drive for use under extremely adverse conditions.

When the unit is set for operation in the "drive" range a wet multiple-disc clutch locks the gear train, and the output shaft leading from the planetary system turns at the same speed as the input shaft from the turbine. Necessary variations in torque applied are furnished by the converter and the drive becomes practically equivalent to the conventional direct drive or "third gear" as the vehicle attains operating speed.

To obtain "emergency low" drive the band is applied to the low drum, locking the low range reaction gear in place. The low planet pinions receive power from the driving sun gear splined to the input shaft and transmit it to the reverse pinions. As the low range reaction gear is locked in place the reverse pinions must travel around it, thus driving the planet carrier at reduced forward speed.

In "reverse" drive the reverse band is applied and the ring gear thus locked in place. Power is applied through the driving sun gear and thence through the low planet pinions to the reverse planet pinions. The ring gear being locked, the reverse planet must travel around the ring gear in a direction opposite to their own rotation. This causes the planet carrier to move in the reverse direction at reduced speed.

To place the drive in neutral the clutch and all bands are disengaged and, since there is no reaction member within the planetary system under these conditions, the system spins freely without imparting motion to the planet carrier.

A special gear permits locking of the mechanism to the housing with the remainder of the system in the same condition as in neutral, thus providing a positive lock mechanism for the "park" position.

Buick engineers state that, while the Dynaflow is subject to the energy losses common to all hydraulic drives, engine efficiency gained by operation at optimum speeds is sufficient to offset such losses and bring performance from a fuel economy standpoint to the same level as is found in cars equipped with conventional manually-controlled gear transmissions.

Chrysler Gyrol Fluid Drive

The Chrysler Fluid Drive is a fluid coupling, used in conjunction with a four-speed, hydraulically powered transmission on Chrysler and De Soto motor cars and with a conventional transmission on the Dodge. Earlier models used a similar semi-automatic transmission powered by engine vacuum.

The present power transmission is a modification of the ordinary manually operated sliding-gear type. Selection of high or low range is manual, with shifting between the two gear ratios in each range hydraulically and electrically actuated and controlled by the driver through the accelerator pedal. A clutch pedal is available, but its use is not required in ordinary driving.

Hydra-Matic Drive

General Motors Hydra-Matic Drive is now available as optional equipment on Cadillac, Oldsmobile, and Pontiac motor cars. The drive combines an automatic planetary-type transmission with a fluid coupling, and is one of the oldest automatic transmissions in present use. Some design changes have been incorporat-

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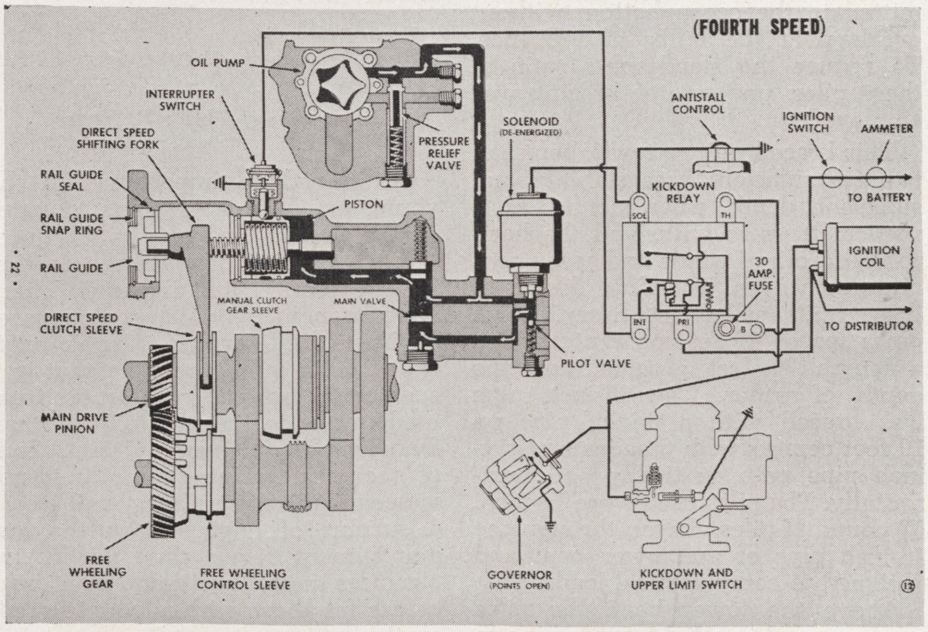

Cut Courtesy Chrysler Corp.

Chrysler Automatic Transmission

Engineering Reviews

Steel H-Piles and Pipe Bents Support Deep-Water Drilling Platform

From *Civil Engineering*, July, 1948—By G. Glen Cappel, Director ASCE.

Reviewed by Alfred A. Yee., sr., c.e.

In 1946, the Humble Oil & Refining Co. asked for proposals and designs for deep-water drilling platforms to be built in the Gulf of Mexico. These structures were to be located several miles off the Louisiana coast, where the water depth is 50 to 60 ft. Hurricanes, high waves, littoral currents and the like are not uncommon in this region.

The proposal of the W. Horace Williams Co. was considered best by the oil company and appropriate contracts were entered into. The proposed design took in considerations of fetch and exposure, bottom characteristics, load concentrations, possible and probable cumulation of forces, rigidity under drilling conditions, areas required for machinery and supply layout, and crew living quarters in addition to the above-mentioned factors of weather and ocean currents.

The basic design of these platforms employed steel H-piles for support. The unit of construction was based on four-pile groups, each group so spaced so that their loads are transmitted to the ocean bottom without overlapping the bulbs of influence. To reduce the slenderness ratio of these piles, underwater bracing was employed.

This braced unit or tower bent had to have sufficient base stability and sufficient depth when acting as a vertical truss to withstand the horizontal forces of winds and ocean currents or waves. The final design of these units called for four 16-inch pipes spaced 10 feet on centers with a length 30 feet greater than the depth of water. The 16-inch pipe was braced with a 6-inch pipe on 10 feet centers with diagonals of six-inch pipe both vertically and horizontally. The piles used were 10-inch, 57 pound H-piles, driven through the 16-inch pipe of the tower bent and designed to carry vertical loads.

Above the tower bent, the piles were encased in a light gauge pipe in order to offer a circular surface to wave forces and provide protection against corrosion. The tower bent units are braced to each other 10 feet above sea level and the whole structure trussed with sway rods from the braces to the caps at 30 feet. This arrangement was to provide maximum strength and rigidity with the least amount of surface exposed to water forces.

After a series of borings, it was calculated that a pile penetration of 134 feet would afford sufficient bearing to expected loads without any appreciable settlement. However, to insure safety in the structure, the design called for penetrations between 150 feet and 200 feet.

The design is so arranged that up to 14 wells can be drilled from one location. Crew quarters for the maximum working force have been adequately provided for. The superstructure is all-welded.

Though present design data on offshore structures are not yet far enough advanced to make possible the most economical design, it is believed that this plan is on the right track. Nevertheless, with further experience in such construction, there is no doubt that improvement in design and operation will result.

An Engineer In The Electronics Industry

From *Proceedings of the IDE*. June, 1948 —By H. B. Richmond of the General Radio Company.

Reviewed by Philip R. Vance, sr., e.e.

Of immediate importance to the young engineer who plans to enter the Electronics Industry is the question of his own adequate preparation for a career in that industry. There have been many dire predictions of an impending surplus of radio engineers. It is quite probable that any such conditions will result more from inadequate technical training than from lack of job opportunities. A lack of technical training will limit advancement in this industry and create a surplus of engineers in the low employment levels, but the future promises more positions than ever before for those with adequate preparation.

A recent survey showed that one quarter of all engineering graduates are electrical engineers, with the majority of these being in the field of communications. Thousands of young men received technical training in communications and radar during the last war. The G. I. Bill gave these men the opportunity to advance themselves to an engineering status. In two more years the supply of electrical engineers having a B. S. degree is expected to be increased fourfold. Taken by itself this will not create a serious employment situation. The problem arises from the fact that the majority of these men are concentrating in the field of communications.

According to a recent spot check in the electronics industry, the starting pay for a man holding a B. S. degree is about $250 a month. For a man holding a M. S. degree the starting pay is about $25 to $50 a month higher, and the man holding the doctors degree starts at about $100 a month higher than the man with the B. S.

Magnesium Castings — Their Production and Use

From *Mechanical Engineering*, May, 1948 —By A. W. Winson and M. E. Brooks.

Reviewed by Howard P. Freers, sr., m.e.

Magnesium casting alloys are distinguished by their low weight, high strength, easy machinability, and other desirable characteristics. These alloys can be cast by any of the commonly used foundry methods, such as green sand, dry sand, plaster, permanent mold and die castings. And there is experimental work in centrifugal casting going on. In general the casting of magnesium alloys is done the same as any common metal, except where changes are required by its light weight and the chemical and thermal characteristics of magnesium.

The decision as to how the castings will be fabricated depends upon a number of factors. In general a part of any size and complexity is made by sand-casting. Fairly simple castings which are needed in quantities of over 1000 may be considered for permanent mold castings. Die castings can be used when the section is

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Walking Dragline

By Robert Schwier, jr., ch.e.

The Maumee Collieries Company, operating in and around Vigo county, Indiana, have recently become the proud owners of one of the coal business's biggest and best "strippers," or, in more technical terms, excavators. This excavator is no common machine, for it actually "walks to work" on two kingsized shoes, 9 feet wide and 54 feet long, taking 7 foot strides, and moving its 1,400 tons at a speed of 0.11 miles per hour. The reason for the unusual name, "stripper", is due to its unique job in the coal field. The machine is used to strip the useless top soil and overburden from the useful vein of coal, the unique part being that this excavator can do the job better and faster than any ever before manufactured.

No superlatives can describe the excavator in proper proportion for only cold facts and a few comparisons can approach the unbelievable immensity of its construction. First of all its name is the Bucyrus-Erie 1150-B Walking Dragline, a name appropriately derived from its odd means of locomotion. The "dragline", as it is usually called, is possibly the largest self-motivated land machine evre built, and has the world's largest mobile dragline boom yet constructed—215 feet in length.

Another first to its fame is that it is the first air-conditioned excavator of this type. The entire cab is pressurized with dust-free, filtered air to prevent even the slightest amount of dust from entering the cab through such small holes as cable openings, etc. This air conditioning is performed by the use of three five-horsepower motors which drive three 36-inch, propeller type fans delivering a total of 60,000 cubic feet of air per minute. Seventy-seven filter units of the oil impingement type, each with a cross sectional area of 400 square inches, clean the air as it is drawn into the cab.

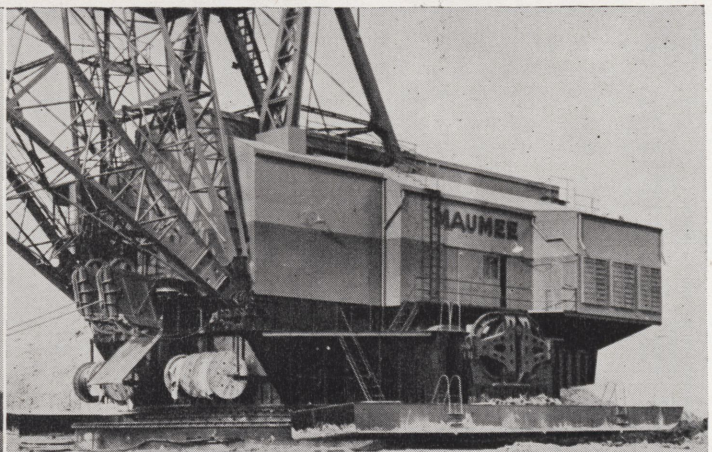
The boom proportions illustrate some of the most useful points of the dragline. The boom can handle a loaded bucket weighing 130,000 pounds and deposit its load 360 feet from the digging point. With its 215-foot boom at an angle of 42 degrees, it can dig 120 feet below the ground, and dump about 60 feet above. The top of the boom is somewhat over the height of a five story building and is reputed to attain a velocity of 50 to 60 miles per hour on the swing. Large draglines such as the 1150-B have made possible the recovery of coal at greater depths because of their greater working ranges and—in mines where proper roof cannot be obtained — coal which would otherwise remain forever underground, since the cost of removing the deep overburden would be prohibitive by any other means. To show the expected speed of the excavator, for it has not been in operation long enough to determine accurate speeds, a similar dragline of somewhat smaller proportions was able to average 35,000 cubic yards of dirt every 24 hours, or, approximately 8.5 average basements per hour.

The dragline with a working weight of 2,470,000 pounds, was built in South Milwaukee, Wisconsin, and assembled in the field. A total of 55 railway cars was required to ship the giant machine, and a total of almost 4 months needed for the field assemblage. It rests on a circular base 50 feet in diameter and of 1,965 square foot area. Because of the large ground area the pressure on the base averages only 11 to 12 pounds per square inch. Even more important, the 1150-B is designed so that its center of gravity shifts through predetermined limits as the machine digs, lifts, swings and dumps. This eliminates the destructive stresses which occur when a wide shift of the center of gravity causes the base to dig in at the edges and build up a cone of earth beneath itself.

The revolving frame of the big dragline moves on a roller circle 34 feet in diameter, consisting of 116 nine-inch rollers which form what amounts to a large roller bearing. The deck area of the revolving framc is about 1,900 square feet—29¼ feet

Concluded On Page 25

World's largest Walking Dragline in action.



View showing base and feet in operating position.

Research And Development

By Dale Carey, soph.,
and J. R. Brentlinger, soph.

You May Paint Your House With "Invisible Sunlight"

You'll be painting your house with "invisible sunlight" thanks to pigments that soak up light you can't see and give off vivid colors.

Chemical research reported to the American Chemical Society has increased tenfold the luminescent qualities of paint pigments.

During the war major improvements were made in materials that glow in the dark, and now the fact that some of these have "daylight fluorescence" is being applied to signs, soap and paint.

Ultraviolet light is absorbed on striking the mtaerials and then emitted as visible color. The addition of this color to the normal reflection gives a more brilliant hue than can be obtained by reflection alone.

Intermittent Noise Will Not "Drown Out" Conversation

Although a loud continuous noise will "drown out" another noise and make conversation impossible, the effect is entirely different if the masking noise is intermittent, as in a burst of machine-gun fire.

Interrupting the noise cuts down on its effectiveness as a mask, but the extent to which it is cut down depends also on the frequency of the interruption, on the pitch of the drowned-out sound and on the loudness of the noise.

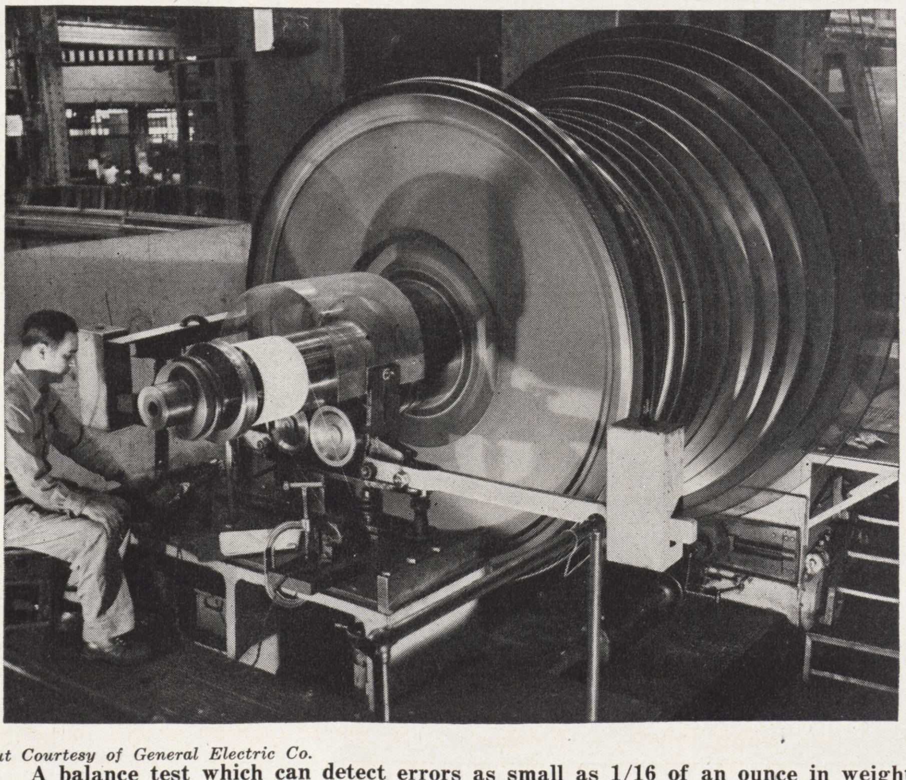
If the noise is on and off only once in ten seconds, the conversation can be heard without too much difficulty. But, on the other hand, if the interruption is very high—on and off 5,000 times a second—one can hear almost as well as if there were no noise.

If a person listens to speech accompanied by a noise that is interrupted 300 times a second, the speech sounds intermittent, but practically every word can be heard just as though listening in a quiet room.

A curious effect was discovered, however, when the investigators tried filling in the intervals between words with a noise. For this purpose they used what scientists call "white noise," that is, a noise containing all the frequencies at random.

Now the speech no longer sounded intermittent. The words were understood just as well as when there was no "masking" noise.

The intelligibility of conversation is less if it comes in abruptly and is chopped off suddenly. It is more easily understood in the same length of time if it comes in and fades out more gradually.



Cut Courtesy of General Electric Co.

A balance test which can detect errors as small as 1/16 of an ounce in weight distribution of this 43,000 lb. turbine rotor, is shown. The rotor, designed for a 20,000 k.w. steam turbine, is turned slowly by an electric motor and any fluctuations in the weight are noted by the operator.

First Gas Turbine Engine for an Electrical Utility Ready Soon

A gas turbine engine, now under construction, will be installed in Oklahoma City to develop electricity. It will probably be the first gas turbine used for an electrical utility in this country.

The engine is a duplicate of a 4,800-horsepower locomotive gas turbine now undergoing tests. The installation will be a 3,500-kilowatt gas-turbine generator set. It will be ready for operation in about a year.

Natural gas will be used for fuel in this gas-turbine installation, a fuel of which this locality has an ample supply. Another advantage of this type of power plant is that the gas turbine requires practically no water and water in this region is not as plentiful as in most localities.

In the gas turbine, fuel is mixed with air under pressure in an air-cooled combustion chamber, and the resulting gases are expanded through the turbine. Maintenance is low because the gas turbine has only two major moving parts. Oil may be used for fuel as well as natural gas. A coal-burning gas turbine also has been developed, and will be used on locomotives. The coal used must first be very finely pulverized, and burns in the combustion chamber in a swirling mass of air.

Continued On Page 29

Great Men of Science

COUNT BENJAMIN RUMFORD

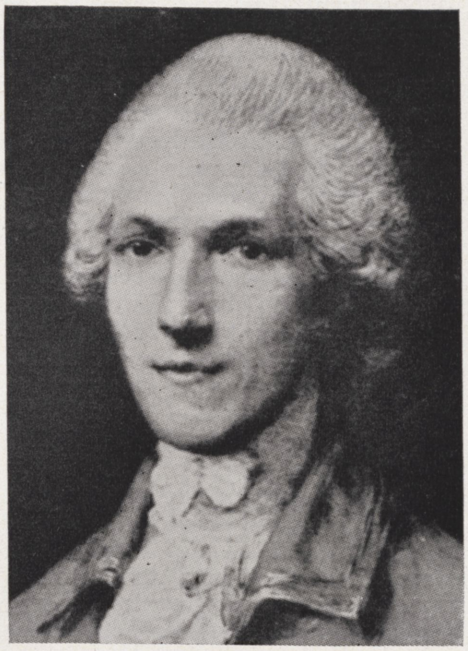
By William Orbaugh, jr., ch.e.

For hundreds of years heat and fire have been household expressions used to describe phenomena which appear alike but in reality are widely separated. So great has been the association between them that, long after the *phlogiston* of fire was dispensed with, its cousin persisted in the form of the so-called *caloric* of heat. As it took Lavoisier to demonstrate the nonexistence of phlogiston, so it rested with Count Rumford to dispatch caloric.

As was learned in the Lavoisier story, the phlogistonists seemed to have a special talent for pursuing a course which was in exact opposition to the facts. So it was with the calorists in their search for an explanation of heat phenomena. In both cases, what was incomprehensible to the body of 18th century science was understood by the one man who undertook to correlate the data at hand by flavoring his rigorous logic with a "dash" of inspiration. Rumford merely employed a unifying process. Great theories, we are reminded, are born in the minds of men of genius whose rare talents may be compared to those of the artist. A work of art can no more be produced by a committee of artists than can a great theory be evolved by a round-table conference of specialists.

Medieval ideas on the nature of heat and the crude notions of ancients before them had been delivered to modern man as a helter-skelter collection of old wives' tales. To some of the early thinkers, heat was a peculiar substance having no weight; hence it was called an "imponderable". Others spoke of it as a fluid which permeated the atomic spaces of matter and could be poured from a hotter to a colder body just as water might be poured from a higher to a lower level. Still others believed that heat was an indestructible substance and uncreatable by any process; bodies became warmer when caloric was added to them and grew colder as caloric was taken out.

This accumulation of erroneous conceptions and faulty observations became a part of traditional thinking and was regarded as semi-sacred by popular acceptance. To doubt that heat was a material fluid was to question the wisdom of the early thinkers. The material conception of heat became a part of the scientific credo of an English doctor, William Gilbert, who lived in the 16th century.



Count Benjamin Rumford

Gilbert was a man of considerable importance in the history of science, founding the sciences of electricity and magnetism. He was a pioneer in the use of the experimental method; however, many of his ideas were poisoned with the mysticism of the middle-ages: he thought that magnets were possessed with some sort of soul or spirit. He regarded heat, light, electricity, and magnetism as forms of matter, and this notion of the materiality of heat, or caloric, was universally accepted and taught until Sir Benjamin Thompson, Count Rumford (1753-1814), demolished it.

Thompson's early training was obtained in a piecemeal fashion: first there was John Fowle, a Harvard College graduate, who tutored him as a young boy; then came a session at a provincial school which was followed by several tuitions under able teachers. From the scraps of information available today, it appears that young Thompson possessed an unusually active mind, and from the varied personalities of his tutors, he developed interest in many things.

At an early age, Thompson gave evidence of being able to do three things: think for himself, experiment, and theorize. By self-teaching and practice, he became an able and accurate draftsman and something of an artist, too. The versatility of theorizers, men such as Lavoisier and Thompson, is a continual surprise. Thompson takes his place among them in the classical stream of their many accomplishments. As he grew in mental stature, his ingenuity was sufficiently great to meet every practical and theoretical problem in the long catalogue of his many achievements. Without relying on the aid of a single person, he designed his own inventions. In his youth he undertook in a boyish way to experiment with fireworks. This interest marked the beginning of a line of thought which eventually led him to formulate the correct theory of the nature of heat.

When he was nineteen, Thompson married the rich, thirty-three-year old widow of British Colonel Rolfe. He had matured early, both mentally and physically, and had been appointed teacher in Concord, Massachusetts, before he was eighteen. Here he was described as "of a fine manly make and figure, six feet tall, of handsome features, with the manners and polish of a gentleman, with fascinating ways and an ability to make himself agreeable." His striking personality and good appearance brought him to the attention of Governor Wentworth at Portsmouth, New Hampshire, who soon was as favorably impressed with Thompson's mind. He immediately assigned him to public service, and from that time to the end of his long career, he was a man of public affairs.

In the discontent which preceded the American Revolutionary War, Thompson was on the side of the Government, a Tory. The friend of

Continued On Page 24

Campus Survey

By James Morris, jr., c.e.

Back to the Salt Mines

After a month away from the old grind, the students of Rose returned for another year of pain. Some of the returning students had fine new R.O.T.C. commissions, some had money they had earned during the vacation, while others had only their hands in their pockets and a satisfied look on their faces.

Of the returning student body, perhaps the freshmen were the least anxious to come back. They had been subjected to a rather strenuous bit of training during their first term, and knew that this term they would be charged with the traditional job of erecting the homecoming bonfire. However, before the first week was finished the sophomore class announced that a tug of war would be held between the two classes.

The sophomores made extensive preparations for the contest. There was, however, an air of fair play and sportsmanship throughout the whole affair. It was indeed touching, the concern that the sophomores showed for school property. Fearing that during the struggle the rope might be lost in the lake, they took protective measures and tied their end to a telephone pole. The freshmen, upon examination of their end of the rope, found that the sophomores had barely provided them with enough to reach across the lake.

Rather than bother their adversaries, they spliced a piece of their own hemp to the rope already provided. The freshmen, as usual, were unobservant, for had they looked closely they would have discovered that the rope they spliced onto the first line was attached to the trunk of a tree. It was purely an oversight on the part of the freshman class.

Thus with the rope firmly anchored on one side to a telephone pole and on the other to a tree, the contest began. The inevitable happened, but the freshmen were the recipients of the stroke of ill fate, for the rope broke, severing their ranks. With half of their pulling power knocked out, the remaining greencaps were hastily pulled into the drink.

What followed is history. The freshmen crossed the lake and threw the sophomores in; the sophomores crawled out and tossed the freshmen back in; when they tired of this they joined forces and attempted to lake the spectators. Needless to say, the area was hastily cleared, leaving only the freshmen and sophomores to lick their wounds.

Glee Club Season

The always-active Rose Tech Glee Club ended one season and began another almost before the members had time to take a deep breath. The 1947-1948 season, which was one of the most successful in the club's history, closed with the annual Formal Concert on June 4 and an appearance at the Interfraternity Sing. The Glee Club sang at the four Terre Haute public schools and at many civic and church organizations during the past four months.

The Glee Club, starting the new term with high spirits, met and elected Eugene Glass, president; William Orbaugh, business manager; and Fred Corban, publicity agent for the present season. The first business of the Club was the adoption of new by-laws. All the members are now busy learning the new program.

All but two of last year's twenty-three members have returned.

Honor Fraternities Tap New Class

At a recent honor assembly, the Blue Key and Tau Beta Pi honorary fraternities conducted another tapping ceremony. In the shade of the giant oak in front of the main building, students and faculty of Rose watched these fraternities select nineteen outstanding men from the student body. Of the nineteen men selected Blue Key claimed only one, Mr. Tim Kelly, who had distinguished himself in many activities throughout the school. Men elected to Tau Beta Pi were Alfred A. Yee, Leonard Albers, Allen S. Stewart, Fujie Matsuda, Leonard Silverman, Shinji Soneda, Paul C. Hill, Robert Erskine, Warren F. Albrecht, Joseph Mees, Emil Quattroni, David Jarett, John W. Clark, C. Nelson Havill, James P. Laughlin, A. Ray Osburn, John D. Winters, and Frederick L. Corban.

Professor E. A. McLean, of the faculty, was also elected to membership in Tau Beta Pi on the basis of his outstanding engineering achievements.

R Men's Dance

The new term's social season was formally initiated by the R Men's association with an informal dance that was originally scheduled for the tennis courts. However, the Gods of the elements did not smile kindly upon our athletes and the rains came. The dance was moved to the old gym though, and a large crowd attended despite the foul weather.

The short end.

Alumni News

By Edward Meagher, sr., ch.e.
and Mort Hief, soph.

Claude G. Gray

The following resolution was passed at their last meeting by the Board of Managers of the Institute.

"The members of the Board of Managers of Rose Polytechnic Institute wish to record their great sorrow and sense of loss at the death of Claude Gray. Although he had been a member of the Board a comparatively short time, Claude Gray had served as a valuable member of several important committees. At the time of his death he was sharing responsibility for the selection of satisfactory candidates for the presidency of the Institute."

"Claude Gray was graduated from Rose in 1921, and in twenty-six years had risen through various positions in the transportation industry to the presidency of the Baltimore Transit Company. His engineering ability had been demonstrated frequently in the organization of operating and maintenance departments for efficient public service."

"Always interested in Rose, Mr. Gray had been active in alumni affairs, and just prior to his election to this Board he had completed a term as president of tthe Alumni Association."

"To Mrs. Gray and her daughter, the Board wishes to extend deepest sympathy and to express their admiration and affection for Mr. Gray and appreciation for his great helpfulness to Rose."

J. B. Aikman

One of the few remaining members of the school's second graduating class, John B. Aikman, died last July 11 in Washington, D. C. Aikman, 82 years old, died as the result of a hip fracture.

Born in Washington, Ind., Aikman came to Terre Haute in 1883 as a member of the first class to take the full course at Rose, graduating in mechanical engineering in 1887.

His first job after graduation was with the Colorado Midland Railroad, but he soon returned to Terre Haute to enter the wholesale stationery business of his father-in-law, a position which he held until 1909. After leaving Terre Haute, Aikman was an executive for White and Wyckoff, Inc., stationery manufacturers of Holyoke, Mass., until 1920. From 1920 until his retirement in 1946 he had served as general manager of the Vermont Talc Company of Chester, Vt.

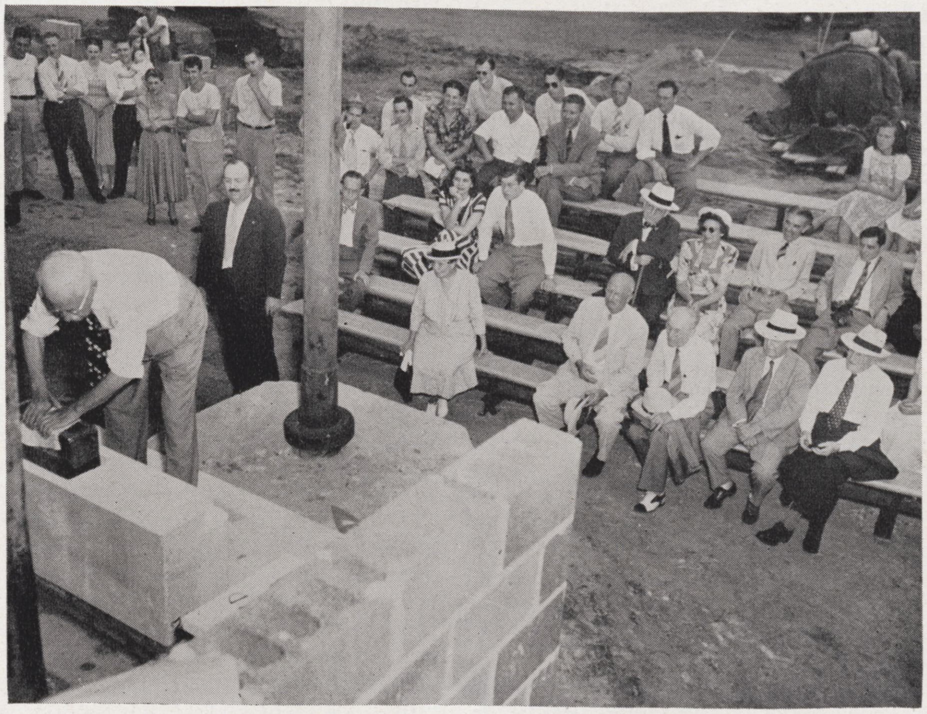
Mr. Aikman was always active in Rose affairs. He served as a member of the Board of Trustees and was one of the early guiding hands of the Alumni Association, serving as its president in 1891 and 1909 and as secretary-treasurer from 1893 to 1905.

'25 Edward G. Gray has been appointed works engineer of General Electric Company's laminated plastics plant in Coshocton, Ohio. A graduate in mechanical engineering, Mr. Gray received a Master's degree in the same field from M. I. T. in 1928. Except for time spent in graduate work, he has been with General Electric ever since his graduation from Rose. Mr. Gray joined the company's plastics division in 1928 as Cleveland sales representative and was promoted to commercial engineer of laminated products in 1947.

'27 Thomas B. Crutcher, Jr., head of Crutcher Sales Company, manufacturers agents, has been elected president of Local Bottled-Gas Dealers, Inc., of Louisville. The purpose of the organization is to promote the use and sales of bottled-gas appliances.

Philip A. Minnis died in San Jose, Cal., last July 28. At the time of his death he was patent counsel for the Food Machinery Corporation of San Jose.

'29 G. P. Brosman has been appointed Plant Extension Engineer, State Area for Illinois Bell Telephone. Mr. Brosman began with Illinois Bell as a student engineer in State Area Traffic in July, 1929. He was transferred to State Area Engineering in 1939 as an engineer, and was appointed exchange cost studies engineer in 1945. While on leave from 1942 to 1944, he served as a civilian with the Naval Ordnance Laboratory in Washington, D. C.



And a goodly crowd was there.

Fraternity Notes

Sigma Nu

With the opening of the summer term, Beta Upsilon of Sigma Nu held their annual stag which ushered the chapter back to the old grind in grand style.

The chapter is proud to announce that formal initiation was held June 6, 1948, for Lester Wright, Malcolm Meurer, Jack Gruenholz, Clyde Winkler, Frank Mardjetko, Edmund Dudek, and William Miller.

Baseball sweaters and letters were earned by Waldo George and Malcolm Meurer, Jim Schwier receiving a manager's letter and sweater.

The third annual Starlight Dance was held by Sigma Nu on the tennis courts August 21. An enjoyable evening was spent by all dancing under the stars.

Work being done on the house includes the painting of the upstairs hall and new lighting fixtures; also the pouring of concrete in the front room of the basement, which will be a new game room.

Brother Bill Miller passed out cigars at the first meeting of this term. Alumni Jim Wade, Carl Monzel, Charles Butel and Dick Hickman were recently married. Brother Ted Kadel has also joined the ranks.

Alpha Tau Omega

Sun Valley, Idaho, was the site chosen for the National Convention of Alpha Tau Omega this year. As the delegate for Indiana Gamma Chapter, Brother John DeReamer spent not only a very enlightening but a very enjoyable four days at this famous resort.

On August 7, the actives and pledges of the chapter and the alumni of the city met at a dinner meeting held at the Y.M.C.A. Brother Herb Patterson served as toastmaster, and Brother Bob Simons of the National Executive Secretary's Office delivered a short speech concerning active alumni relations. The guest speaker for the evening was Mr. George Bankoff of the Rose chemical engineering department.

In the line of congratulations, the chapter wishes to express its appreciation and commend highly the efforts of Brothers John Winters and Bob Schwier for their work in organizing and editing the first publication of our quarterly news-letter, *The Gamma Gamma Gazette*. One of the primary functions of the paper is to acquaint our alumni with some of the happenings at the present time, present some of the problems with which the active chapter is faced, and to promote a closer bond between the brothers now out of college and those of us still struggling.

The chapter wishes to welcome back to its ranks again Brother Jack Sills. Along with Jack came Monster Number Two, namely, that long low '31 Studebaker roadster that may be seen about the campus these days.

The old cry of "Mother, take down the service flag—I'm home from the wars," has been sounded around the house with the return of the fellows from the ROTC summer camp at Fort Belvoir, Va. Back with us again after building numerous bridges, constructing many miles of roads, and suffering the rigors and hardships of Washington, D.C., weekends, are Dave Mullen, Gene Ervin, Ben Miller, and Bill Schumann. We also have two brand new second lieutenants, Mark Orelup and Bob Cassidy, but we don't like to talk about that.

Lambda Chi Alpha

After a well-deserved four-week vacation, the members of Lambda Chi returned to school with increased vim and vigor to face the oncoming summer term.

Cigars were quite plentiful at the fraternity house during the first several weeks of the new term. Claiborne Motsinger was married to Patricia Gallagher, and William Tilton was married to Patricia Powell. Al Kiefer was engaged to Mary Biehle, and Bill Pittman gave his pin to Betty Scott.

Many improvements have been made at the fraternity house during the past several weeks. The interior was completely redecorated; this accompanies exterior decorating which was done last Spring. All the rooms were papered, and the study rooms were painted. With the help of the Mothers' Club, new living room furniture and lamps were purchased. The addition of these new improvements has put the fraternity house in very good condition.

At a recent meeting, Al Schmidt gave a report of the General Assembly of Lambda Chi Alpha which he attended as the fraternity's delegate. The Assembly was held at Asheville, North Carolina, during the last part of June.

Three of the members of Lambda Chi attended the ROTC summer camp which was held at Fort Belvoir, Virginia during the vacation. They were Robert Bitting, Claiborne Motsinger, and Al Schmidt.

Brother John Mitchell, with of course the help of his wife, is the proud father of a baby girl, Victoria, who was born during the summer vacation.

The chapter was happy to have three former members visit the fraternity house. They were Robert Bannister, '46; Warren Haverkamp, '46; and Charles Bashe, '47.

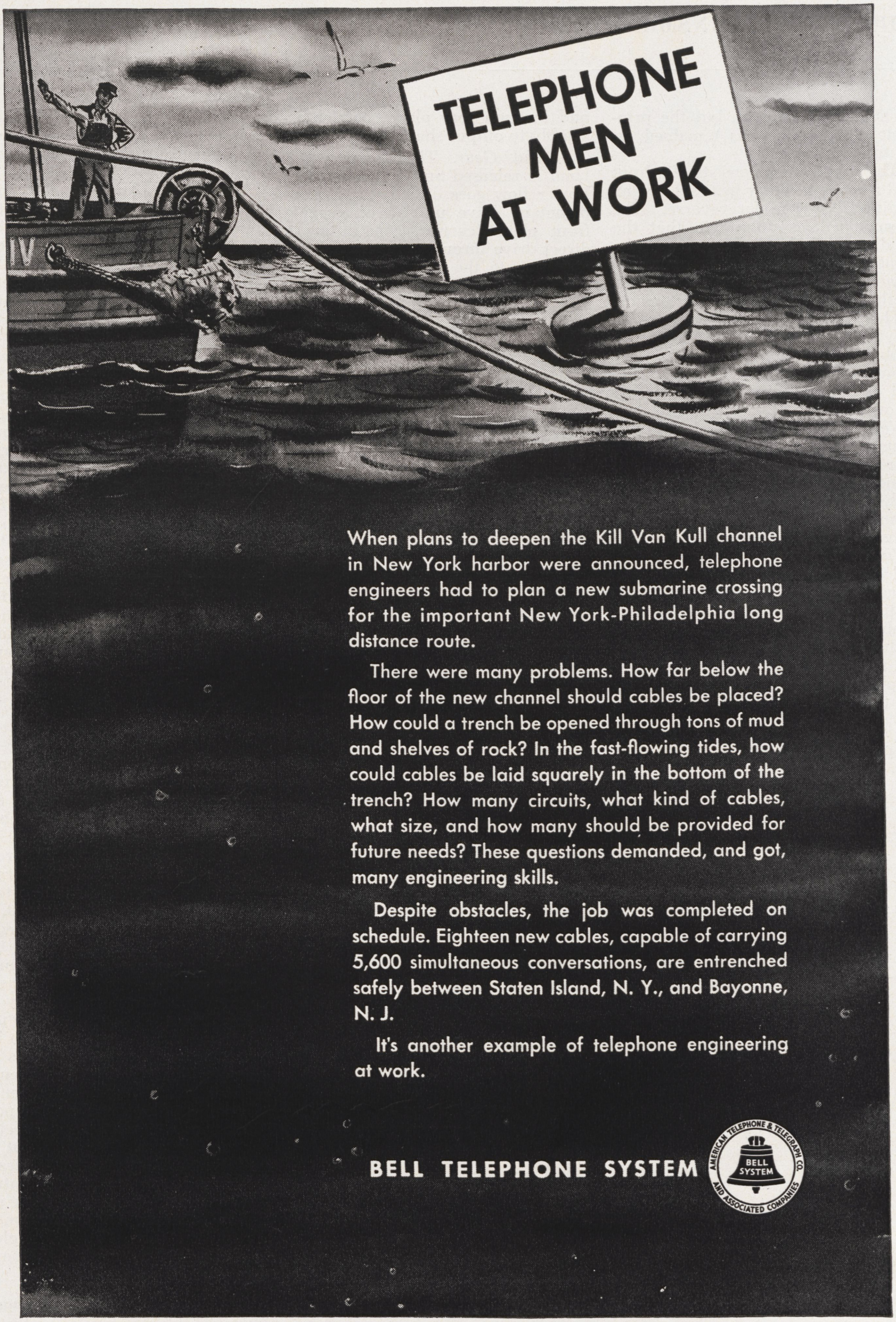
Theta Xi

Now that the summer vacation is only a fond memory, school activity is once again in full sway. Plans are now being made for the forthcoming rush parties. With our rush program in the hands of such a capable brother as Bob Campbell, we can all be assured that it will turn out very successful.

At our regular meeting on Monday, August 9, the chapter was honored by a visit from Dr. Odon S. Knight, our delegate to the Grand Lodge. Dr. Knight visits our meetings frequently to help us with any problems that may arise.

At the close of the summer term one of our brothers, George McNeil, completed his studies at Rose. Recently Brother McNeil was married to Miss Dee Lee Jones of Bloomfield, Indiana. They will make their home in Jonesboro, La., where he is now employed. Two more of our brothers found occasion to take the fatal step during the summer months. On July 10, Otto Andres was married to Miss Jeanne Schuler of Jeffersonville, Indiana. From Indianapolis we have news that Bob Penno was married to Miss Mary Walker.

Frank Dorfmeyer has announced his engagement to Miss Catherine Huntley. Miss Huntley is a student nurse at the Women's Hospital in Philadelphia. Our most recent casualty was Robert Haswell who has pinned Miss Jo Ann Lyons of Louisville, Ky. The chapter extends its heartiest congratulations.


TELEPHONE MEN AT WORK
When plans to deepen the Kill Van Kull channel in New York harbor were announced, telephone engineers had to plan a new submarine crossing for the important New York-Philadelphia long distance route.
There were many problems. How far below the floor of the new channel should cables be placed? How could a trench be opened through tons of mud and shelves of rock? In the fast-flowing tides, how could cables be laid squarely in the bottom of the trench? How many circuits, what kind of cables, what size, and how many should be provided for future needs? These questions demanded, and got, many engineering skills.
Despite obstacles, the job was completed on schedule. Eighteen new cables, capable of carrying 5,600 simultaneous conversations, are entrenched safely between Staten Island, N. Y., and Bayonne, N. J.
It's another example of telephone engineering at work.
BELL TELEPHONE SYSTEM
AMERICAN TELEPHONE & TELEGRAPH CO.
BELL SYSTEM
AND ASSOCIATED COMPANIES

Continued From Page 9

ed since its inception, but the principle of operation has remained essentially the same.

The gear system consists of a front and a rear planetary gear set and an additional system for reverse. The arrangement is unique in that the fluid coupling is placed between the front and rear planetary units in the power flow, rather than coupled directly to the engine as is customary.

The transmission is controlled by a hydraulic system which will not be explained in detail here. Power flow throughout the four forward speeds and in neutral and reverse is as follows:

Neutral. From flywheel through torus cover (fluid coupling cover) to front planetary unit drive gear and thence to front planet pinions. Since both planet clutches and bands are disengaged, no drive through the transmission takes place.

First Gear. Both bands are applied and both planet clutches released. Power flow begins as in neutral, but continues through planet carrier assembly to intermediate shaft, thence to driving member of fluid coupling and through oil to driven member of coupling, thence to main shaft leading to rear planet system sun gear and through rear planet carrier assembly to output shaft.

Second Gear. The front planet band is released and clutch applied. Power flow goes directly from front planetary drive unit drive gear to front planet carrier, constituting a direct drive through the front planetary unit to the driving member of the fluid coupling. Remainder of drive is same as in first gear..

Third Gear. The front planet band is reapplied and clutch released, while rear planet band is released and clutch applied. Flow through front unit is the same as in first gear, but torque is split at intermediate shaft with approximately 40% passing through fluid coupling and 60% passing directly to rear planet carrier through rear clutch. The portion passing through the fluid coupling flows as in first gear and is added to the mechanically transmitted portion at the rear planet carrier. The resulting gear reduction is 1.45:1.

Fourth Gear. Both clutches are applied and both bands released. Power flow in front unit is same as in second gear, in rear unit the same as in third gear. The result is again a splitting of torque in the same proportion as in third gear, but with no reduction taking place in either planetary unit the effective result is direct drive.

Reverse. An additional planetary gearset is brought into play, with the remainder of the system operating as in first gear. The additional gearset forms a compound system with the rear planet system to reverse propeller-shaft rotation with additional gear reduction.

Packard Electromatic Clutch

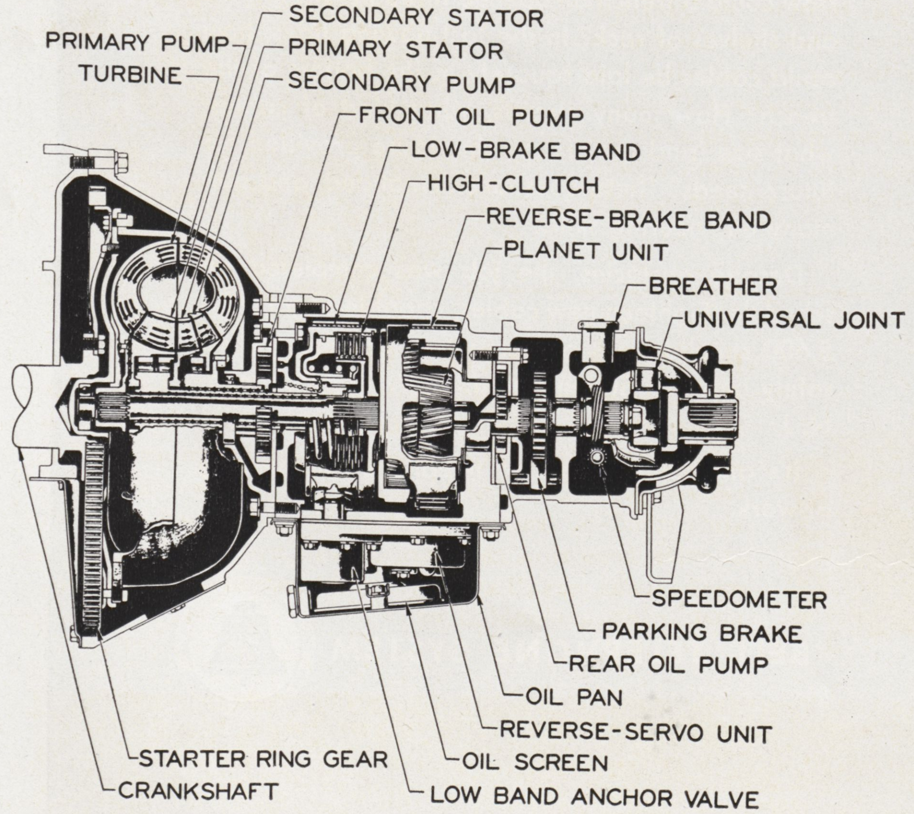
The Packard Electromatic Clutch is an electrically controlled vacuum-operated mechanism providing for automatic clutch operation. The engine must be started in neutral or with clutch pedal applied, but all further driving may be carried on without the use of the pedal. If desired, the automatic mechanism may be cut out by means of a dashboard switch and the clutch pedal used in the conventional manner. The clutch automatically cuts out at speeds below 17 miles per hour when the accelerator pedal is released; at higher speeds a governor switch prevents freewheeling. The system insures smooth shifting and driver convenience.

Hudson Drivemaster

The Hudson Drivemaster consists of a powered semi-automatic transmission in combination with an automatic vacuum-operated clutch. A switch for selection of manual control, automatic clutch operation alone, or automatic drive operation is provided; the automatic clutch is also available as a separate unit, and is known as the Hudson Vacumotive Drive.

The transmission differs from ordinary manually-controlled transmissions only in its power supply and solenoid control. Starting takes place in second gear, and shifting to high gear is accomplished by means of a power cylinder operating on engine vacuum and actuated by momentary release of the accelerator pedal. Placing of the shift lever in either low or reverse gear cuts out the automatic shift system and places the transmission under manual control.

When the vacuum clutch is used by itself, shifting is carried out manually without the use of the clutch pedal, providing smooth automatic engagement.



Cut Courtesy Buick

The Buick "Dynaflow" turbine.

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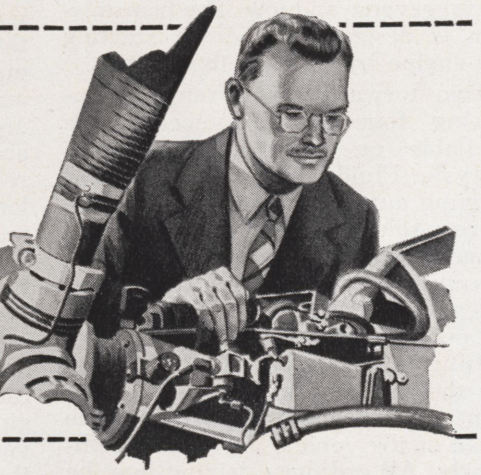
CAREERS AT GENERAL ELECTRIC

General Electric is not one business, but an organization of many businesses, offering opportunities in virtually all the professions. Here three G-E men brief the career-possibilities which the company offers to the . . . METALLURGIST . . . GAS TURBINE ENGINEER . . . NUCLEAR SPECIALIST

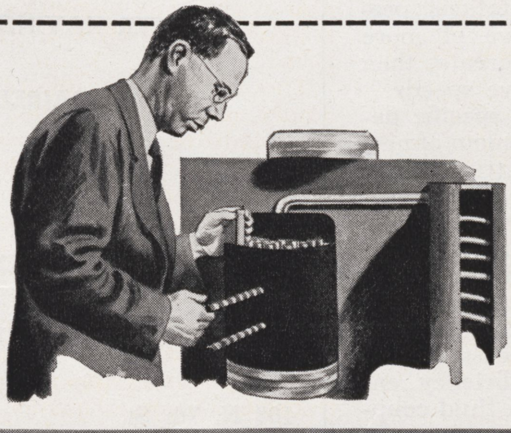
METALLURGIST

Dr. Zay Jeffries (South Dakota State School of Mines '10), vice president and general manager of the Chemical Department: "As an example of General Electric's opportunities for metallurgical engineers, consider our interest in the permanent magnet business. Here are opportunities not only to pioneer new applications but also to develop better alloys and techniques. Many industrial applications wait only the ingenuity of the design engineer using today's new magnetic alloys."

GAS TURBINE ENGINEER



Alan Howard (Purdue '27) designer of G-E jet engines and now directing development of gas turbines for railroad, marine, and industrial applications: "General Electric is building the country's first gas turbine for an electrical utility . . . is testing a 4800 hp unit for locomotives. Developments like these are creating an ever greater demand for men who can handle tough problems in aerodynamics, thermodynamics, combustion, control processes, and metallurgy."



NUCLEAR SPECIALIST

Dr. K. H. Kingdon (McMaster, '14), head of the Atomic Power Division of the G-E Research Laboratory: "It is a mistake to think that atomic energy work has room only for *nuclear* physicists. The problems call for physicists who understand measurements of thermal conductivity, heat transfer, corrosion, theory of control, hydrodynamics, and mechanisms, as well as nuclear cross section measurements, nuclear instrumentation, etc."

For further information about a BUSINESS career with General Electric, write Business Training Course, Schenectady, N. Y.—a career in TECHNICAL FIELDS, write Technical Personnel Division, Schenectady, N. Y.

GENERAL ELECTRIC

 Concluded From Page 18

Operation

The Buick Dynaflow control system is relatively simple. An indicator mounted on the steering column shows which of five possible positions—park, neutral, drive, low, or reverse—has been selected. The engine may be started in either park or neutral, a safety switch preventing engagement of the starter in any other position. For normal driving the selector lever may then be moved to the drive position and no further shifting will be necessary during operation. The emergency low position is used only under conditions requiring exceptionally high drive ratios, as in mud or sand or on extremely steep grades. Shifting between the low and drive positions is possible at any time in either direction, but downshifting at speeds above 40 miles per hour is obviously inadvisable. There is no clutch pedal.

The Dynaflow transmission makes it possible to rock the car out of tough spots by applying light throttle and moving the shift lever between reverse and low. The transmission is designed to permit starting the engine by pushing the vehicle.

Two forward speed ranges comprising four forward speeds are available on cars equipped with Chrysler Fluid Drive and the accompanying automatic transmission. The driver selects either high or low range through the use of the shift lever; upshifting in either range then takes place on releasing the accelerator pedal momentarily, while downshifting is accomplished by depressing the pedal past the full throttle point or automatically when the speed of the vehicle is reduced sufficiently. All ordinary driving may be accomplished in high range, with the car starting in third. The reverse gear is engaged by placing the shift lever in the customary position. A clutch pedal is provided to insure maneuverability and complete control; it need not be operated in ordinary driving, but is used if it should become necessary to start the automobile by towing or pushing.

The Hydra-Matic Drive constitutes a fully automatic transmission. The engine is started with the shift lever in neutral position; the lever is then moved to the drive position and may remain there for all normal forward driving. If continued operation in first or second gear becomes desirable, placing the shift lever in the low range position prevents automatic shifting into third or fourth gear. A reverse position is also provided.

Shifting throughout the various gears is hydraulically controlled through governors, no action on the part of the driver being required. There is no clutch pedal.

It is reported that the Tucker automobile is to include independent torque converters for the rear wheels; no further details are available at this time.

Overdrives

There are several other automatic transmissions that have been available at one time or another; in view of their similarity to the systems described, and because of space limitations, they will not be discussed here. The overdrive transmission, however, is quite generally in use and may well be considered at this point.

Many cars incorporate an overdrive in the transmission, either as an added unit or fourth gear or as an additional gear range. Overdrive mechanisms may employ conventional gear trains or planetary gear systems; they may be designed to cut in and out at the discretion of the driver or automatically when certain speeds are reached. If driver controlled they are usually engaged by momentary release of the accelerator pedal, unloading an overrunning clutch and making engagement possible, and similarly disengaged by depressing the accelerator beyond the full-throttle position.

The principal function of overdrives is the attainment of greater fuel economy and reduction of engine wear. Engine limitations prevent speeds in overdrive of more than five to ten per cent greater than corresponding direct drive speeds.

Gradual correction of specific deficiencies and the development of new devices such as the electromagnetic clutch should result in general acceptance of no-shift driving by the public in the near future. The advantages of automatic shifting when driving under crowded conditions are self-evident, and the only serious obstacle remaining is the somewhat reduced transmission efficiency encountered in all forms of fluid couplings.

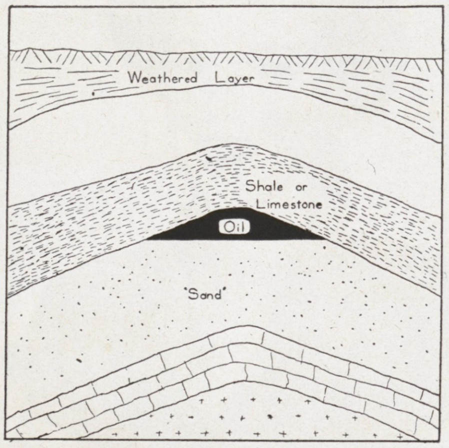
It is generally agreed that competition among automotive manufacturers will force the adoption of some form of automatic drive in all cars within a few years.

 Continued From Page 7

shot hole above the charge. This time is used in calculating the velocity of the seismic waves in the weathered layer. (3) The arrival of the refraction waves at the various geophones by the shortest time paths; (4) Arrival at the geophones of waves reflected from the various beds.

A principal problem in reflection shooting is the separation of reflected impulses from all others of a different character, that is, not only from the first high-speed refraction impulses but also from low-speed surface waves and other refraction impulses arriving after the first impulses. The principal means of separating refractions from reflections is the use of multiplicity of receivers. Interfering impulses will arrive at each receiver in proportion to the speed in their respective media, whereas the reflected waves, because of their vertical incidence, arrive virtually at the same time. When multiple receivers are connected in series, there is an additional possibility of eliminating refractions and reinforcing reflections.

A near-surface "weathered" or 'correction" zone with a considerable reduction in velocity occurs in every area. As this layer is not likely to be identical at all stations, it has become general practice to correct for the delay of the reflected waves in this layer. When conditions are different



A structural oil trap.

at the individual receiving stations, the time delay for each geophone must be determined. Corrections are also made for the varying elevations of the separate geophones.

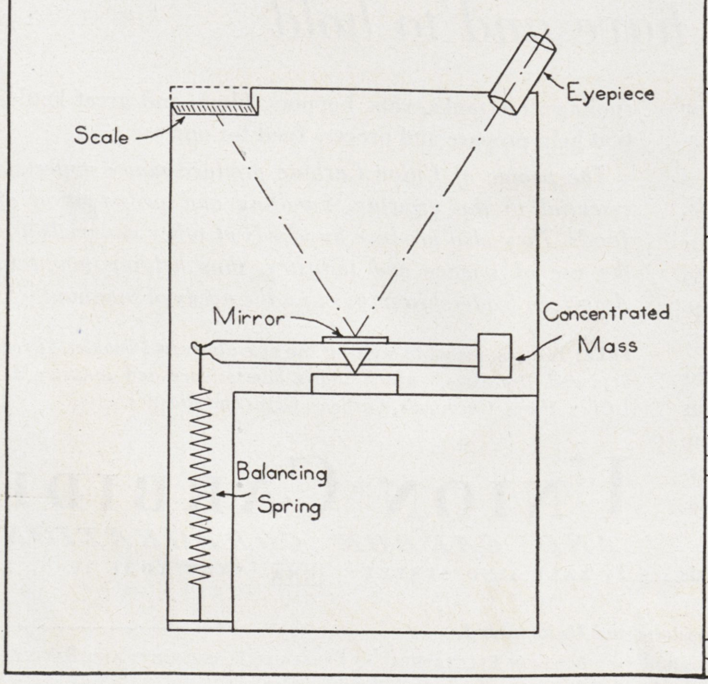
Simple travel-time relations are readily calculated on the assumption that the reflections originate on plane horizontal or inclined surfaces. These relations are used directly in mapping the subsurface structure. It has been found that since the reflection wave paths are nearly vertical, they may be assumed straight. Actually the paths are frequently curved slightly due to the steadily increasing density with depth of the strata in which the waves travel. The wave paths also have offsets due to refractions in reflecting beds higher up in the section. For inclined beds at least two sets of travel-time relations obtained from two lines of geophones set at right angles to each other on the ground are required for interpretation.

The reflection seismographing method is the most exact and the most important geophysical prospecting method in use today. In this capacity it has recently replaced the refraction seismic method which is based on the interpretation of the refractive waves discussed above. However, the refractive method is still in wide use today.

Other Methods

The magnetic method, which is very similar to the gravitational method, measures variations in the earth's magnetic field. The airborne magnetometer, a very recent development, is finding wide use. This method utilizes the wartime-developed Shoran radar and has the advantage of giving continuous readings.

The resistivity method, the most important electrical method in use today, measures the varying resistance to an alternating current sent through a portion of the earth. This method has the possibility of locating oil in what are known as stratigraphic traps, which, since they have no characteristic structure, cannot be



Gravity meter.

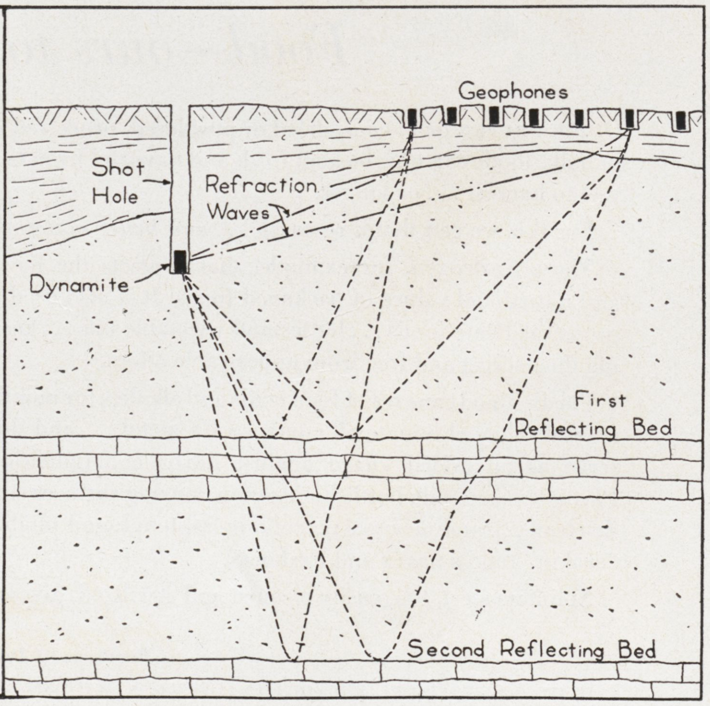


Diagram showing path of reflected shock waves.

located by ordinary prospecting methods.

Cut Courtesy Sohioan, Published by Standard Oil, (Ohio)
Taking a gravity meter observation.

 Continued From Page 13

the Colonial Governor, he came into strong public disapproval and decided it best to leave the country. Events led to his arrest and imprisonment at Woburn. Upon his release, he sailed in 1775 for England and expatriated himself, leaving his family behind and his property confiscated. On his arrival in London he attached himself to the service of the Colonial Office, where he was its expert on American affairs.

But while always busy with public affairs, Thompson found time to experiment. As with Lavoisier, thought alone was never sufficient for him—he felt a need for verification. As a youngster he had been interested in fireworks, guns, and gunpowder; these things fascinated him not alone as toys or sport, but because of their importance in world affairs. The adolescent interest now ripened into a mature search for accurate knowledge. In addition, he turned his attention to improvements in military matters and promoted several new devices. His ability was recognized by the Royal Society, and in 1779 he was elected a Fellow. In 1784 he was knighted by the king.

Shortly after receiving these English honors, Benjamin Thompson, now Sir Benjamin, was on the Continent. No man loved medals, decorations, honors, title, and rank more than he. Maximilian recommended him to the Elector of Bavaria, who proposed him military and civil posts in Bavaria with full power to reshape and reorganize the Bavarian army. Thompson accepted. He became minister of War, minister of Police, and Grand Chamberlain to the Elector. So this once poor farmer lad from faraway New England moved into a palace in Munich to exercise an authority second only to the king's. He was now on the road to world honors and immortal fame.

A man of method, Thompson approached every problem in terms of a scientific inquiry. So remarkable were his reforms in the fields of military, social and civic affairs, as well as in education, sanitation, housing, land reclamation, hospital work, poor-relief, and food supply problems, that the Elector conferred upon him the glittering title *Count Rumford,* nobleman of the Holy Roman Empire. At this time, he founded and endowed the historic *Rumford Medal* of the Royal Society, and presented a like amount to the American Academy of Arts and Sciences.

As a philosopher, Rumford was aware of the dangerous tendency of the human intellect to accept as valid a plausible explanation and then look for facts to support that explanation. In his experiments on heat he was constantly on his guard to avoid this mistake.

What led Rumford to heat? He had long been concerned with military problems and had regarded gunpowder as an important factor in the affairs of men and nations. In England in 1778, Rumford continued his scientific inquiries into guns and gunpowder and the enormous amounts of heat generated in their manufacture and use. While engaged in supervising the boring of cannon in the workshops of the military arsenal at Munich, Thompson was struck with the considerable degree of heat which a brass gun acquired in a short time in being bored. This was the beginning for the first experimental demonstration of the non-material nature of heat.

The calorists had believed that friction merely rubbed or squezed out the heat from the inter-atomic space of the bodies, just as water is squeezed from a wet sponge. Rumford set out to prove that this sponge idea and all that it implied were ridiculous. He did it by a few simple boring experiments in the munition workshop. First he took a very blunt boring tool, and arranged that the metal cannon should be surrounded with water so that all the heat produced would go into the water. What he then had, in effect, was a crude calorimeter. Then he got a pair of horses to keep turning this blunt

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wide and 62 feet long. Below the main frame, which houses the operating machinery, is a sub-frame which houses the walking machinery shafts. The main machinery deck is 16 feet, 2 inches above the ground.

The entire dragline is electrically operated through flexible power cable delivering 33,000 volts alternating current. This voltage is stepped down to 4,000 volts A. C., which drives two motor generators, which in turn deliver power to the operating direct current motors. The General Electric amplidyne control system is used to obtain faster acceleration and deceleration, a speedier cycle and smoother digging, hoisting and swinging. The actual control is performed in the operator's cab which is 23 feet above the ground, and projects from the side of the machine so the operator has an unobstructed view of his work. Of course the most interesting part of the 1150-B is its odd means of moving. This would be a "sidewalk superintendent's" paradise if it were not that the machine is several miles from any town or city. During the digging cycle, the shoes, size 54 feet by 9 feet, are carried above the ground so the machine is free to swing. To move the machine, a walking shaft 22 inches in diameter turns two cams, each 6 feet in diameter, to lower the shoes to the ground.

As the cams continue to turn, part of the weight of the machine is transferred from the base to the shoes, the base tilts up and forward, breaking ground suction, and the whole machine skids or "steps" about 7 feet backward. As it settles down once more on its base, the shoes are again raised to carrying position, ready for another step.

The walking cycle is accomplished smoothly, without jerks or shocks. It is possible for the 1150-B to step out in any direction, for the position of the shoes depends on the position of the deck house which can revolve 360 degrees in either direction about the base. This means the dragline can walk around obstructions, sidestep at any angle, and choose its own route of travel.

Bucyrus-Erie draglines of this type are used not only in the soft coal fields of Indiana and Illinois, but also in the Pennsylvania anthracite district, Florida phosphate mining region, and iron ore mining in the Mesabi Range in Minnesota.

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boring tool in order to generate heat by friction.

The water got hotter and hotter. After tramping the circle for two and a half hours, the horses had generated enough heat in the cannon to boil the water. To the great amazement of the spectators the water continued to boil so long as the horses continued their boring. "Heat", Rumford said at the time, "may thus be produced merely on the strength of a horse, and, in a case of necessity, this heat might be used in cooking victuals."

This was the first time, on record at any rate, that water had been made to boil without the use of fire. "In reasoning on this subject," Rumford said, "we must not forget that *most remarkable circumstance*, that the source of the heat generated by friction in these experiments appeared evidently to be *inexhaustible*." (The italics are Rumford's). "It is hardly necessary to add that anything which any *insulated* body or system of bodies can continue to furnish *without limitation* cannot possibly be a *material substance* . . ."

Rumford recorded the results of his experiments and his theory in a paper entitled *Enquiry Concerning the Source of Heat which is Exited by Friction*. The net result of his work was to destroy the entire conception of the corpuscular theory of heat which regarded heat as a substance. The question of the existence of an *igneous fluid* or a something called *caloric* (heat stuff) came to an end. His experiments were conclusive; *he established for all time* that heat is not a species of matter but a species of motion and that no body either gains or loses weight by virtue of being merely heated or cooled. His theory became an effective formula with which to work. Within less than a century was founded the science of thermodynamics. Upon the dethronement of the material theory of heat a new era began, an era open for the acquisition of significant knowledge which led to results greater than at any previous period in man's history. Once it became understood that mechanical energy and heat are mutually convertible, the rest was comparatively easy. Rumford's part as a pioneer should not be underestimated. The principles announced by him are now clear, but they were evolved only through much original work in the face of hostile contemporary conditions. Robert Boyle experimented with heat problems before Rumford was born. He too generated heat by friction. But his conclusions were erroneous, for he believed in the materiality of heat. Simple as facts are, they are nevertheless notoriously difficult to uncover. A trained observer is often slow to recognize them even when they stare at him. Indeed, it is surprising how simple all great discoveries become, after someone else has made them. Rumford should be granted his due.

Ironically enough, in view of his expatriation earlier, the United States Ambassador in London then proposed in the name of the newly established republic ". . . in addition to the superintendence of the Military Academy, the appointment of Inspector General of the Artillery of the United States; and we shall moreover be disposed to give you such rank and emoluments . . . as would be likely to afford your satisfaction, and to secure to us the advantage of your service." Rumford declined, however, and instead turned his genius for organization and science to another project which had possessed him, the creating of the Royal Institute of Great Britain, in which he took the leading role. Being an opportunist of sorts, Rumford promptly then engaged the research of the young English chemist, Humphry Davy, to supplement and confirm his own work.

In 1814, at the age of sixty-two, Count Rumford died. Aside from his great work in heat, Thompson left several sums of money to research foundations, including an annuity for Harvard.

What perhaps is a fitting commentary on Rumford's accomplishments is a sentence by John Tyndall, taken from his *Heat as a Mode of Motion*: "When the history of the dynamical theory of heat is completely written, the man who, in opposition to the scientific belief of his time, could experiment and reason upon experiment as Rumford did . . . may count upon a foremost place."

ENGINEERING REVIEWS

Continued From Page 10

thin and uniform and when the quantity requirements are from 1000 to 5000 units.

Pure magnesium ordinarily is not considered as a structural material. When alloyed with aluminum, zinc, and manganese, the alloy has properties comparable to those of aluminum alloys. The alloying elements usually total about 10% and the alloys have a specific gravity only slightly heavier than the pure metal.

Melting of the alloys is usually done in the presence of a flux to prevent oxidation; however, in the die casting process clean ingot metal can be melted in a flux-free pot if the metal is protected by sulphur dioxide.

The same general practice is used in magnesium sand foundries as in those casting other metals. Special features include the flux used for protection during melting, the inhibitor used in the molding sand to prevent reaction between the molten metal and the wet sand, and the care to avoid turbulence during the flow of metal through the mold passages. Magnesium alloys are light and lose heat rapidly, which necessitates generous venting, particularly from thin sections.

The consideration of permanent mold castings should be made only when the quantity is high enough to warrant it, 1000 or more pieces, and when the part is simple enough. The part should be a fairly simple shape, of uniform wall thickness, and without undercuts or complicated internal coring. Permanent mold castings can be made to close tolerances and good finish, and this will frequently eliminate or reduce subsequent machining operations. Metal for pouring is dipped from the pot with a bottom pour ladle designed to prevent flux contamination of the castings. The molds can be made of good quality high carbon gray cast iron. Cores may be of sand or steel.

Magnesium alloys are commonly die cast by the cold chamber high pressure machines. Pressures of 50,000 psi have been used but the general range is 4000-15000 psi. Plunger speed is important in the production of good uniform quality die castings.

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Plunger speeds of 70-350 fpm are used; the higher speeds are used in making thin wall castings, in which it is necessary to fill the die quickly, and the lower speeds in conjunction with higher pressures to produce best quality in internal soundness. The metal is held in the pot under an atmosphere of sulphur dioxide to prevent oxidation. The dies are made of carbon tool stool, 5% chromium tool steel, or 6% tungsten tool steel. The dies must be designed to allow entrance to the cavity with a minimum of turbulence and with adequate venting.

The outstanding characteristic of magnesium is its light weight, one quarter that of iron, and but two-thirds that of aluminum. The light weight of these alloys makes them especially desirable to the aircraft industry.

The more important properties of magnesium alloys are as follows: (1) High strength-weight ratio; (2) easy machinability; (3) non-magnetic; (4) non-sparking; (5) stability under most conditions of use.

The transportation industry is becoming increasingly weight-conscious and with this it is turning to the lighter metals, including magnesium castings.

Portable tools made from light metals are becoming more popular. Almost any tool which is to be carried or used manually can benefit by the incorporation of magnesium castings.

Molybdenum: Steels, Irons, Alloys—

By R. S. Archer, J. Z. Briggs and C. M. Loeb, Jr. July, 1948 by Climax Molybdenum Co. Cloth bound, 391 pages, 188 figures, 91 tables.

Reviewed by Ralph F. Connor. jr., m.e.

The many applications of molybdenum as an alloying element are described in this book, which covers a wide range of materials such as wrought and cast steels, cast irons, and nonferrous alloys. The major emphasis has been placed on the presentation of the fundamentals which guide designers and metallurgists in their selection of the most suitable materials for a given application.

In the past, many books have been confined to the presentation of uncorrelated data on specific compositions, each of which has been treated as a self-sufficient unit. In the present book, an attempt has been made to show the fields of similarity and dissimilarity of the various materials and to indicite some of the factors that may affect the choice of the most economical material for a specific part.

The scope of the book is illustrated by the main section headings: *Technical Effects of Molybdenum; Fundamental Effects of Heat Treatment on Microstructure; Addition of Molybdenum; Wrought Alloy Engineering Steels; Wrought Corrosion Resistant Steels; Wrought Steels for Elevated Temperature Service; Tool Steels; Steel Castings; Cast Iron; Special Purpose and Non-Ferrous Alloys.*

A valuable inclusion is the compilation of much obscure, hard-to-find information on specialty applications, such as exhaust valves, elevated-temperature springs, ferritic gas-turbine steels, high-permeability alloys, contact materials, grid wires, and prosthetic alloys. The appendices include data on standard compositions of American, British, and French engineering steels, working stresses from the Boiler Code, conversion tables, and the physical properties of metallic molybdenum.

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Radar Technique Enters Land-Surveying Field

An optical radar for surveying earth surfaces has been developed. It sends out pulses of light which are reflected back from the point whose position is to be determined, and the distance is measured by the time the light takes to travel forward and back.

The light returning from the reflector falls on a photo-multiplier whose output is amplified to produce a pip, an illuminated spot on a cathode-ray tube. Determining the distance by the transit time of the pulse of light is accomplished by auxiliary circuits which include a local crystal-controlled oscillator. The circuits produce timing markers on the tube which can be made to match the pip produced by the returning light.

Angles are measured as with the conventional surveyor's transit. The optical system makes use of a single parabolic searchlight mirror, the outer portion of which is used for the transmitted beam, while the inner portion is used for the returned beam. The equipment is portable and operates either from storage batteries or from 110-volt alternating current.

Newly-Patented Electron Microanalyzer Useful In Both Pure and Applied Research

An important research tool known as the microanalyzer, useful in both "pure" research and in such applications of physics as metallurgy and mineralogy, has been found.

The instrument is built somewhat like an electron microscope, except that the initial source of rays emits X-rays instead of a stream of electrons. These X-rays are brought as nearly as possible to a single wavelength by passage through a liquid-cooled filter with very thin walls of apppropriate metal, placed directly over the sample to be analyzed.

Impact of the X-rays on the sample causes it to emit a stream of electrons from the other side. Brought to a focus by electromagnetic "lenses" of the familiar electron microscope type, they form an image on a photographic plate or a fluorescent screen.

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New Cesium Vacuum Tube Developed to Change Electrical Current

A new vacuum tube for rectifying alternating current, applicable to 110-volt supply such as used in ordinary commercial service, was announced to the National Academy of Sciences.

This rectifier uses cesium metal both as coating for the hot cathode and as current-carrying vapor. This double use of cesium gives the highest efficiency theoretically obtainable in the thermionic rectifier, combined with unlimited life.

For rectifying and controlling currents at high voltages, a new high-voltage thyratron was described, which will be used in power supply for television transmitters and for direct current power transmission. A new and efficient long-life cathode for thyratrons, which will handle currents as high as 5,000 amperes, was also described.

A new method of detecting and measuring atomic disintegrations that are of such low penetrating power that they can not escape from the vacuum chamber has also been found. They compared this atom study to measuring what happens by observing the recoil of a gun instead of following the flight of the bullet. An amplifier tube is used and its recording depends upon secondary emission, the electrons which are ejected from metal surfaces when they are hit by the primary particles.

Fast Camera Shutter Just Developed Makes 100,000,000 Frames a Second

The fastest camera shutter known to science, capable of operating at a rate of 100,000,000 frames per second, has been revealed.

The camera is about 25,000 times faster than the fastest motion picture camera commercially available. If motions pictures of a bullet leaving the muzzle of a gun were taken at this rate of 100,000,000 frames a second and projected on a screen at the normal rate, the bullet would appear to travel about four feet an hour.

A so-called Kerr cell is the secret of this fast shutter. This cell, long used by scientists, is a glass tube filled with nitrobenzene in which a pair of electrodes is immersed. The Kerr cell is placed between two polarizing plates so set that the polarized light emitted through the first is in the wrong plane to pass through the second. When high voltage is applied to the electrodes in the Kerr cell, the state of the polarization of the polarized light is immediately altered, allowing the light image of the subject being photographed to pass the second plate and on through the camera lens to the film.

By controlling timing of the voltage, photographic records with an effective exposure time of one hundredth of a millionth of a second have been obtained. The camera is designed for use in studying certain rapidly changing phenomena which heretofore science has been unable to observe and record accurately.

Rotor Aircraft Get Boost from Compressed Air Source

Helicopters and autogiros can now be launched on their windmill flights without excessive expenditure of fuel to set their rotors spinning. This is made possible through an auxiliary power system.

A tube runs the length of each blade of the rotor, ending in a jet-reaction nozzle at the tip. When the aircraft is ready for launching, this system is connected to a compressed-air hose, fed off a reel at the bottom of a pit sunk in the launching-field or the deck of a ship. An alternative device is a telescoping tube connected to the compressed-air supply.

Acting turbine-wise, the rotors increase their speed until the craft is airborne. The hose or tube follows it up through its first few feet of lift. When it is fully air-borne and ready to fly off under its own power, the connection is severed and away it goes, while hose or tube is retracted by the ground crew.

Chemical Resistant Coatings Successful In Protecting Metals from Corrosion

Chemical coatings for metals developed in the past few years are reasonably satisfactory in protecting metals from chemical reactions, such as corrosion, under unusual and severe conditions.

These coatings have properties which suggest the term "plastic," and reference to them as plastics has become quite popular. They are chlorinated rubber systems, vinyl systems, vinyl resins and styrene systems.

Chlorinated rubber base paints have been manufactured for more than ten years. They have been successfully used for finishing concrete floors, and also proved satisfactory on the interior of steel tank cars hauling 50% caustic soda solutions where the temperature does not exceed 130 degrees Fahrenheit. They are suitable to protect industrial machinery where equipment must be protected from chemicals, but exhibit relatively poor resistance to fats, oils and solvents.

Vinyl coatings exhibit the best chemical resistance of the group, it is stated. They have excellent solvent resistance but require strong, toxic thinners such as toluol and ketones. They are suitable for both interior and exterior service and are resistant to aromatic solvents, high concentrations of acids, and alkalis. Because of their low solids content, five or six coats are required for adequate protection. They are ineffective at temperatures above 140 degrees Fahrenheit.

Vinyl resin, or vinyl-latex dispersion coatings, perform similarly to the vinyls but have higher solvent resistance. Styrene coatings are of two general types, those in which the resin is "cold plasticized" and those in which the styrene is reacted under heat with vegetable oil plasticizers. Both exhibit excellent resistance to chemicals but poor resistance to solvents. Styrene resistant coatings are relatively new but show considerable promise.

Highlights Among Week's New Patents

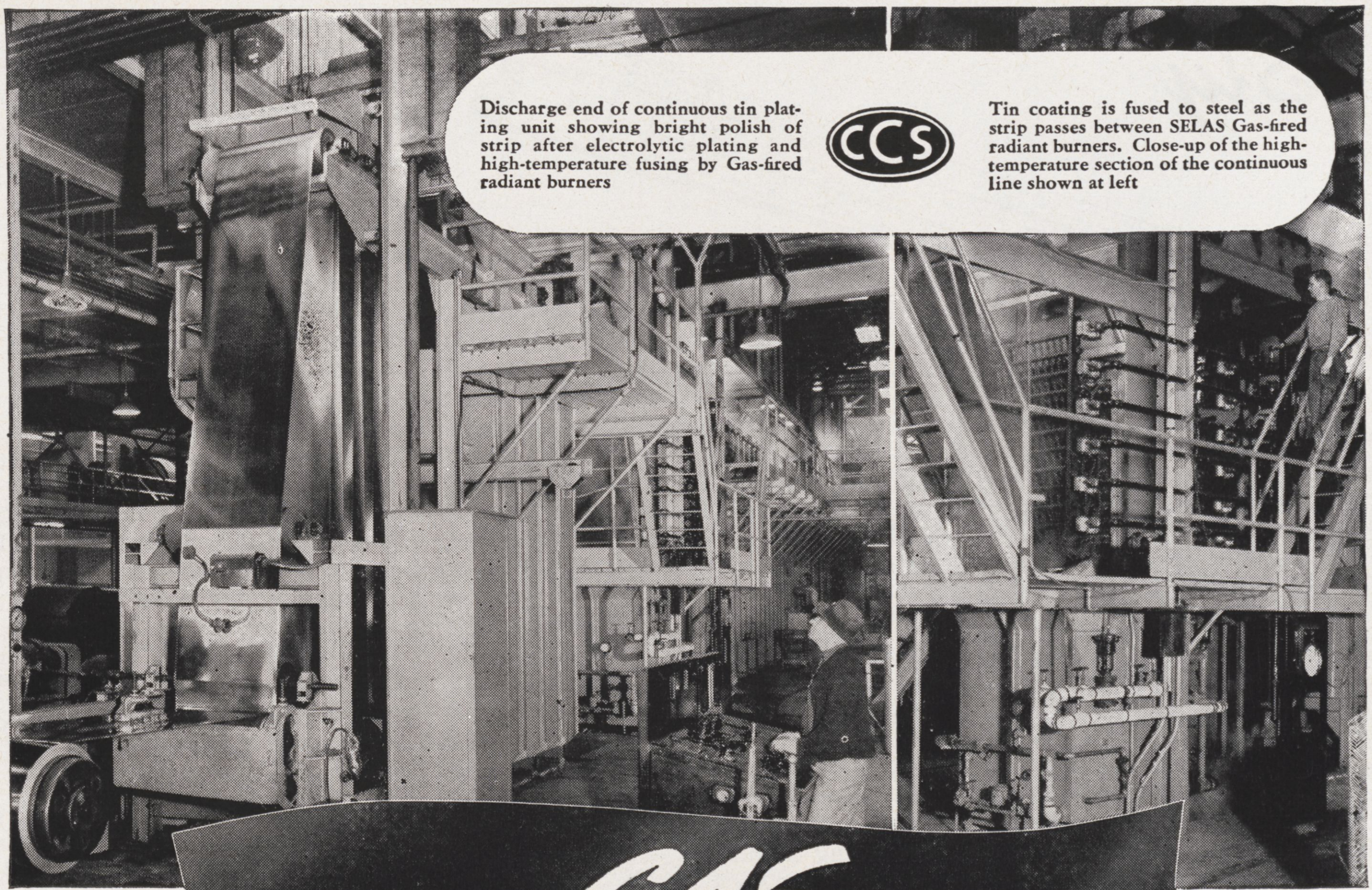
Weekly issues of patents have been slowly increasing recently; the current week's output is 454. Several attract more than passing attention.

Untwisted, relatively large filaments of synthetic material are used for reinforcing rubber tires now instead of the conventional spun-thread cords.

A snow vehicle that uses long, worm-like screws projecting to the rear instead of the tractor-treads familiar on the Army's "weasel" has just been developed.

A continuous-process method for the production of industrial alcohol has just been found. As fermentation approaches completion in the initial vessel, part of the mash is drawn off and subjected to distillation; meanwhile, new wort is introduced at the starting point.

A device for dropping packages (or bombs) from aircraft with one or more whirling wings, like the winged seeds of maple or ash trees, has been developed recently.



Discharge end of continuous tin plating unit showing bright polish of strip after electrolytic plating and high-temperature fusing by Gas-fired radiant burners

Tin coating is fused to steel as the strip passes between SELAS Gas-fired radiant burners. Close-up of the high-temperature section of the continuous line shown at left

RADIANT GAS BURNERS create high-temperature tin-coat fusing zone

BRIGHT FINISHING was the problem—and engineers of Crown Cork and Seal Company, Inc., Baltimore, adopted a high-temperature method for fusing tin to low-carbon strip, with resultant high-polish surface, in a continuous production mill.

Then, to obtain the high temperatures necessary for heat-processing, these engineers selected GAS and modern Gas Equipment. By directing the heat of radiant GAS burners over a concentrated area of the freshly-plated strip it was readily possible to coordinate the fusing action with the plating process to accomplish continuous high-speed production of bright finished strip.

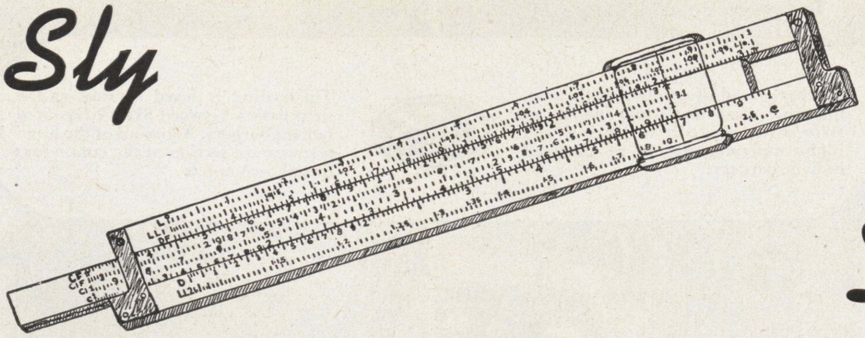
This typical installation demonstrates the flexibility of GAS and the applicability of modern Gas Equipment for continuous, production-line heat processing. Compared with available fuels GAS is most readily controlled by simple automatic devices; Gas Equipment can be adapted for use with existing machinery or incorporated in new machinery without radical design changes, or expensive supplemental apparatus.

Manufacturers of Gas Equipment and the American Gas Association support continuing programs of research designed to assure the most efficient use of GAS for every heat-processing requirement.

AMERICAN GAS ASSOCIATION
420 LEXINGTON AVENUE, NEW YORK 17, N. Y.

MORE AND MORE...
THE TREND IS TO GAS
FOR ALL INDUSTRIAL HEATING

Sly



Droolings

By Robert Campbell, sr., c.e.

The foreman of a logging camp where 100 men and two women were employed was inclined to write lengthy reports. When some well-directed hints did not reach the foreman, the manager issued orders:

"Pat, I'm a very busy man. I haven't time to read long reports. Boil your reports down. Give me the facts in percentages."

Thus in the next report the manager read the following significant story:

"Last month one percent of the men married fifty percent of the women."

* * * *

Economically Speaking

America was better off when we had more whittlers and fewer chiselers.

* * * *

"So you met your wife at a dance. That was romantic!"

"Like hell it was—I thought she was home taking care of the kids."

Short Story

Beneath this stone lies Murphy,
They buried him today.
He lived the life of Riley
While Riley was away.
Finis!

* * * *

Prof: "If there are any dumbbells in this room, please stand up."

There was a long pause, then a lone freshman stood up.

Prof: "What! Do you consider yourself a dumbbell?"

Freshman: "Well, not exactly that, sir, but I hate to see you standing alone."

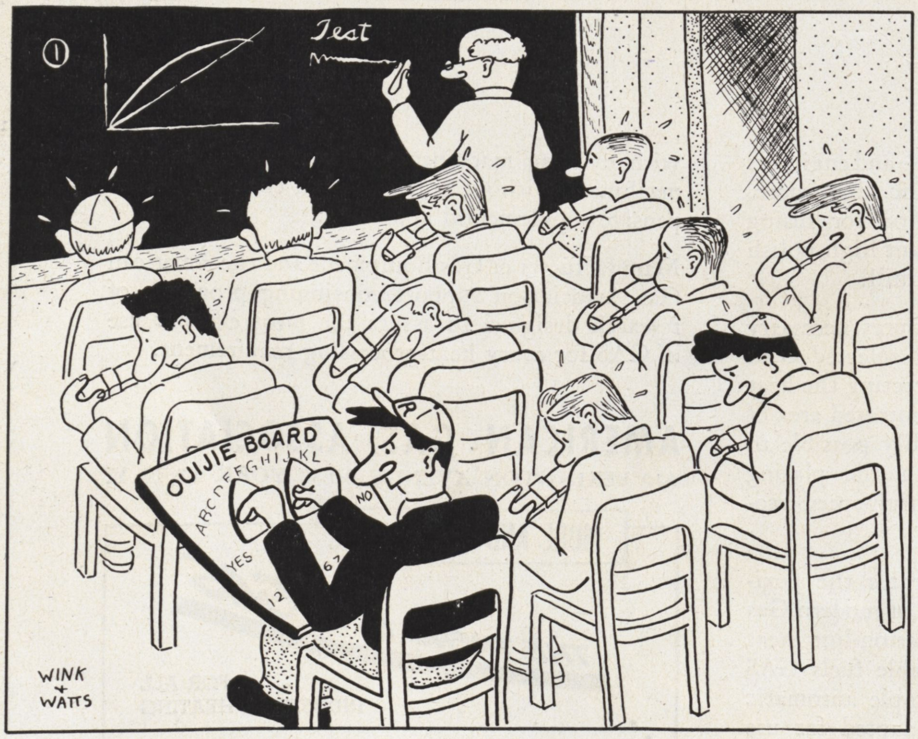
* * * *

Everyone admires a good loser, particularly if he loses to him.

* * * *

Show manager: "Why do you say the show was misrepresented?"

Disappointed patron: "Well, you advertised a chorus of seventy, and none of them looked to be more than sixty."



Editor: "Well, John, I guess you'll have to defend the **Gazette** in another libel suit."

Lawyer: "What is it this time?"

Editor: "We printed in old Leary's obituary that he had gone to a happier home, so now Mrs. Leary is suing us."

* * * *

Customer: "Could I try on that suit in the window?"

Clerk: "Certainly, but we'd rather you'd use the dressing room."

* * * *

Tourist: "I clearly had the right-of-way when this man ran into me, and yet you say that I was to blame."

Local cop: "You certainly were."

Tourist: "I don't get it. Why?"

Local cop: "Because his father is mayor, his brother is chief-of-police, and I go with his sister."

* * * *

Funeral director (to aged mourner): "How old are you?"

Aged mourner: "I'll be 98 next month."

Funeral director: "Hardly worth going home, is it?"

* * * *

Statistics

If all of the automobiles in the world were put end to end, 98% of the drivers would immediately pull out of line to pass the car ahead.

* * * *

Father (telling his son his success story again): "It's time you found a job, my boy. Why when I was your age, I was working for $5.00 a week in a shop, and at the end of five years I owned the shop."

Son: "But you can't do that nowadays, Dad, they've all got cash registers."

* * * *

A party of tourists came upon an Indian brave riding a pony. A heavily burdened squaw walked wearily beside him.

"Why doesn't the squaw ride?" asked one of the tourists.

"Ugh," grunted the Indian, "she got no pony."

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